GROWTH MANAGEMENT STUDIES 2

EXPLOITING END-USER COMPUTING TECHNOLOGY

Ministry of Revenue
Ontario

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Growth Management Studies: 2

EXPLOITING END-USER COMPUTING TECHNOLOGY

Terry Russell
Michael Fick

Ontario
Ministry
of
Revenue

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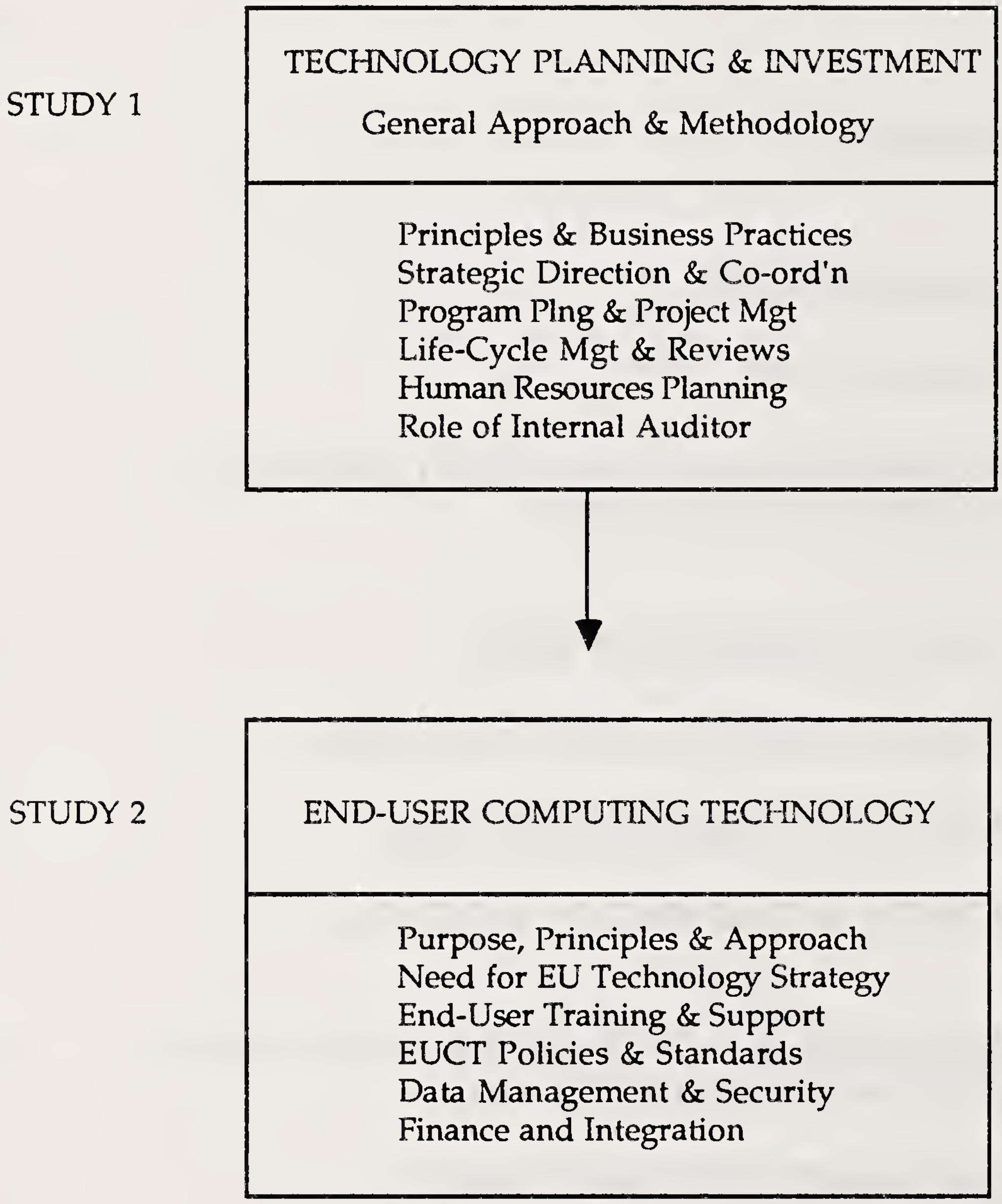

STUDY 1

TECHNOLOGY PLANNING & INVESTMENT

General Approach & Methodology

- Principles & Business Practices
- Strategic Direction & Co-ord'n
- Program Plng & Project Mgt
- Life-Cycle Mgt & Reviews
- Human Resources Planning
- Role of Internal Auditor

STUDY 2

END-USER COMPUTING TECHNOLOGY

- Purpose, Principles & Approach
- Need for EU Technology Strategy
- End-User Training & Support
- EUCT Policies & Standards
- Data Management & Security
- Finance and Integration

PREFACE

In the 1970s the Ministry of Revenue established a full range of large-scale mainframe data processing systems. In 1983 we relocated our head-office operations and 1,600 staff to a new building in Oshawa, which was specifically designed to accommodate then emerging end-user computing and advanced communications technologies. Our plans to exploit these opportunities to generate a 'second wave' of productivity gains, in turn, required the development of new management policies and practices to deal with new patterns of technological change.

Also, in 1984 the Technology Directions Committee of Deputy Ministers commissioned a series of studies by ministries to form the basis of an Information Technology Strategy for the Ontario government. This is one of two undertaken by the Ministry of Revenue. Our first study advanced a general methodology for ensuring that investment decisions are tightly integrated with a ministry's strategic business plans. While that study dealt with technology management in general terms, this study focuses on the particular requirements of supporting a strategy involving diversified and accelerated investments in end-user computing technologies.

Like our first study, this one is based on Revenue's experiences and approach to managing end-user computing technologies. However, we believe the principles and practices which we identify are relevant to other ministries generally.

Originally published in 1984 and 1985, both studies have now been updated to reflect more recent experience in harnessing information technology in the Ministry of Revenue, particularly in managing the growing scale and costs of installed systems, and improving human resources planning to ensure that technological changes are mutally beneficial to our ministry and staff.

In revising these studies, we were helped by many colleagues in the Ministry of Revenue. Foremost among these were Mary Proc, then Executive Assistant to the Deputy Minister and now Director, Taxpayer Services Branch; John Randolph, Executive Director, Information Technology Division; James Evans, Director, Finance and Priorities Planning Branch; Ed Farragher, Director, Personnel Services Branch; David Stones, Director, and Cathy Neal, Communications Assistant, Communications Services Branch.

AUTHORS

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PART A: INTRODUCTION

CHAPTER I: PURPOSE & APPROACH

The purpose of this study is to identify the foundations and requirements of a strategy designed to exploit the potential of new end-user computing and communications technologies simultaneously across a range of programs.

1. Background

Generally, most technology planning and management policies and practices were developed originally to deal with large-scale mainframe investments in the 1970s, which were controlled primarily by systems professionals in ministries and data processing bureaux.

More recently, the rapid development of 'user friendly' hardware and software has generated new opportunities to apply computer technology to activities for which mainframe technology is not economically or technically feasible. In turn, this 'new technology' has created a comparable need to develop more flexible management attitudes and methods in ministries, to deal with the disaggregation of applications, the crucial role of non-technical end-users, and associated risks and cost pressures.

2. Approach

Much has been written about how to achieve 'excellence' in managing technological change. The starting point of our first study was that there is no 'one method' which can be applied consistently to all ministries.[1] As a result, we maintained that each ministry must develop its own planning and management methods based on its own business requirements and technology experience.

---

1. T.M. Russell, J.Evans and M. Fick, Business and Information Technology Planning: General Approach and Methodology (Toronto: Ministry of Revenue, revised 1988). Hereinafter referred to as Study 1.

Diagram 1:1 BASIC RULES

RULE ONE

Since the ultimate purpose of investing in end-user computer technology is to increase program productivity:

All technology decisions should be subservient to business plans and program targets, and should be subjected to the discipline of the technology planning and management system described in Study 1.

RULE TWO

Since the strategic objectives are paramount, the successful exploitation of new investment opportunities and efficient use of installed capacities depend on the initiative, skills and receptiveness of end-users.

It is the responsibility of the Deputy Minister and senior executives to ensure that Ministry end-user computer technology policies and standards are consistent with end-user's needs. This means that end-users should participate in formulating rules and that end-users be given appropriate freedom to seek the best technical solutions to their business problems.

However, while it is expected that there will be wide differences in the ways ministries are obliged or choose to organize their technology business, we also maintained that it is possible to identify a number of commonly accepted principles, practices and objective tests which should be observed and demonstrated by all ministries.

For the present purposes, the tenets of successful technology investment and management, which we demonstrated in Study 1, are summarized by two basic rules in Diagram 1.1. These rules are held to prevail throughout our discussion of the particular requirements of end-user computing technology in this paper.[2]

In this study we are concerned with the attitudes, conditions and practices which are conducive to end-user computing technology within a ministry. However, the ability of ministries to undertake and sustain concerted investment strategies is vitally dependent on encouragement and support by the government.

Just as end-user computing (EUC) requires new management practices within ministries, there is a comparable need for changes to financing and approval processes at the government level. This subject has been discussed more fully elsewhere.[3] Suffice it to say at this point, that such changes should be directed at providing ministries with maximum scope to exercise their initiative to use new technology options according to their different business needs, experience and circumstances.

The organization and contents of the study are summarized in Diagram 1:2.

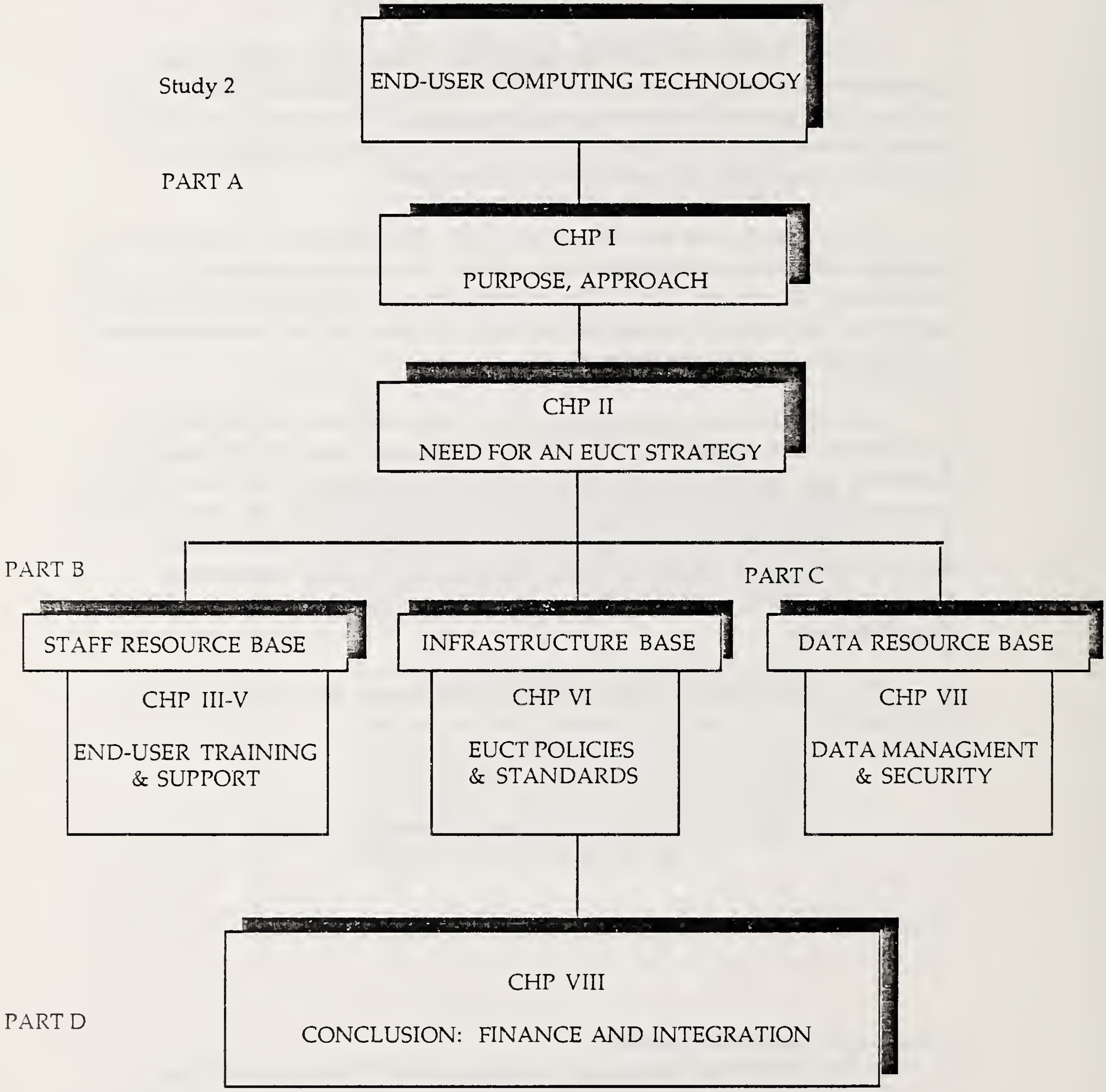
---

2. "End-User Computing Technology" is shortened to EUC throughout this study.

3. Ontario Ministry of Revenue: Terry Russell, "Challenges and Promises of Technological Innovation", Canadian Public Administration, Spring 1986

Diagram 1:2

CONTENTS OF STUDY 2


Study 2
END-USER COMPUTING TECHNOLOGY
PART A
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PURPOSE, APPROACH
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PART B
PART C
STAFF RESOURCE BASE
CHP III-V
END-USER TRAINING & SUPPORT
INFRASTRUCTURE BASE
CHP VI
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CHAPTER II: THE NEED FOR AN END-USER COMPUTING TECHNOLOGY STRATEGY

The purpose of this chapter is to establish the need for a strategy to govern the growth of end-user computing, as an integral part of a ministry's overall technology investment planning and management processes.

The proliferation of EUC hardware and software products generates new opportunities for applying computer technology to business needs which are not well served by traditional mainframe systems. Successful exploitation depends ultimately on the initiative and skills of end-users. But it also involves choices, risks and cost pressures which require close executive direction and support.

Particular attention, therefore, is given throughout to the role of the Deputy Minister and Program Heads in providing leadership, setting priorities and co-ordinating diverse EUC investments in a multi-program ministry.

First, the Deputy Minister and senior executives are responsible for establishing the operational foundations for an effective investment strategy, involving:

- awareness among managers and staff of the potential for EUC and applications;
- creation of an environment conducive to the acceptance and growth of EUC;
- the supply of informed and trained end-users needed to support planned investments;
- the acquisition and management of the infrastructure of hardware and software tools; and
- data management, quality and security.

Second, it is the responsibility of senior management to ensure that EUC investments are consistent with the ministry's overall Business Plans and are subjected to rigorous evaluation (as described in our Study 1).

A. CHARACTERISTICS AND GROWTH OF EUC

The rapid development of EUC is based on advances in microelectronic 'chip' technology, which allow the transfer and distribution of computing power to the workplace of program staff who are not trained systems professionals.

This shift in the locus of computing from mainframe installations has been described by a host of prophetic terms such as: the 'automated office', 'intelligent workstation' and 'wired office'.[1]

Generally, there are two major factors which influence the growth and proliferation of EUC: the availability and adaptability of purportedly 'user-friendly' hardware (HW), software packages (SW), and programming languages and tools.

1. Availability of EUC Technology

In contrast with the long development lead-times associated with traditional mainframe applications, EUC offers a number of prospective advantages.

- A wide range of reliable EUC equipment is readily available on an 'off-the-shelf' basis.
- There is a high and increasing degree of compatibility among competing HW and SW products, particularly as suppliers adopt *de facto* IBM technical standards.
- Severe competition among suppliers is steadily reducing prices.

---

[1] Revenue's first comprehensive examination of the implication of this trend was in the study "Office of the Future," 1980

- Inexpensive and proven 'canned' SW packages are available for most standard office functions.

- For more advanced and specialized SW needs, programming languages and techniques are available which do not require extensive professional training.

- Parallel advances in telecommunications technology provide cost-effective ways of moving data among users: e.g. from mainframe-based to Local Area Networks.

- EUC hardware and software are increasingly well-supported by suppliers, manuals and self-training routines.

- Also, a ministry's information technology division can usually provide a nucleus of trainers in the early stages of EUC applications.

2. Adaptability of EUC

The profusion of hardware and software computing options provides an almost infinite range of new opportunities to increase end-users' exploitation of data more effectively and efficiently.

Extension of Mainframe Computing. EUC can extend the range of opportunities for computerization to activities for which mainframe (MF) applications are not feasible operationally or economically, or which would otherwise require expensive retooling of MF systems and programs.

The development of data-base technology, 'downloading' data to personal or mini-computers, and 'user-friendly' programming techniques create new options for data selection, combination and analysis which were previously amenable only to essentially manual manipulation.

Substitution for Mainframe Computing. This involves using EUC as a faster, less expensive alternative to large mainframes for non-repetitive, unique or small-scale applications. It is also important in avoiding pressure on limited MF capacities, scarce programming staff and transmission costs.

Systems Design, Experimentation and Testing. In the area of operations research, EUC provides relatively inexpensive and faster ways of bench-testing and costing new computer applications, before committing resources to either large-scale MF or distributed processing systems.

B. STRATEGIC MANAGEMENT ISSUES AND PROBLEMS

The potential for productivity gains through EUC is generally well known and accepted. It is less apparent how a diversified enterprise should proceed to exploit these assumed opportunities.

1. Delegation to End-Users

In the absence of a proven methodology, empirical observation and case studies reveal a tendency for corporations and ministries to pursue a 'laissez-faire' approach by which decisions to invest in EUC are explicitly or implicitly delegated to end-users.

Also, such terms as 'end-user driven', 'personal' computers and 'decision-support systems' implicitly support the common sense of relying on end-users to identify profitable opportunities, and to select the HW and SW solutions best suited to their business needs. At the same time, disaggregation appears to offer the safeguard of at least containing mistakes within tolerable boundaries.

While the delegation of decisions may be the best way of ensuring the operational success of *particular applications,* it implicitly involves the possibility of an *uneven pattern* of gains which may not conform to overall ministry priorities. Also, it may pre-empt or limit other choices more suitable for ministry-wide applications at a later date.

Similarly, the gains obtained by the limited application of EUC at one stage of an interrelated set of operations can be easily negated by bottlenecks and disruptions in the other stages.

2. Complexity of Technical Choices

Despite their common features, competitive products invariably have differences which make some better than others for particular purposes. Alternatively, a product that may be second best for a particular purpose may be more suitable where it offers advantages for more general use.

The ability to choose the 'right' product depends on market intelligence and the assessment of competing products. Among factors to be weighed and tested are:

- the reliability of suppliers and products;
- compatibility of new choices with existing equipment and other users' needs;
- 'user-friendliness' and training packages; and
- the life-prospects of products and their development potential.

In practice, there are limits to the ability of most line-managers and end-users to evaluate alternative products, particularly in the early stages of EUC investment when they have little operating experience to draw on. Even when end-users have acquired considerable experience, it is unlikely they can remain sufficiently up-to-date with the rapid pace of new product offerings. More likely, they will continue to need professional assistance in finding and assessing the relative advantages of subsequent enhancements.

Consequently, it is the responsibility of senior management to ensure that end-users are provided with the necessary professional advice and support in the selection of HW and SW products.

In whatever ways this support is provided, the objective is to avoid diverting valuable end-user staff and resources from ongoing production operations. This involves such time-consuming activities as: negotiations with suppliers, product testing and delivery, preparation of required MF reprogramming, data-base links, end-user networks, and other logistical requirements.

3. Hardware and Software Costs

Given the functional merits of competing products, acquisition and running costs are also important factors in selecting hardware and software.

Reinforcing the tendency to delegate responsibility to end-users is the apparent inexpensiveness of equipment and software compared to investments in mainframe applications. Low unit-costs may allow purchases to be tailored conveniently to fit existing budgets without provoking painful reallocations among branches or programs. This is likely to result in a response by management of, "O.K., if you've got the funds, buy 'em and try 'em. If they work, buy some more next year."

This approach may well be appropriate and sensible in the early stages of EUC investment, when there is a distinct value in encouraging experimentation and 'hands-on' experience. In this period, there are also likely to be distinct advantages in allowing more adventurous branches to exercise their initiative for the encouragement of others.

The validity of decentralization, however, depends on whether the costs of such experimental or limited-purpose applications are, in fact, as low as they might appear. In practice, acquisitions often involve significant hidden and downstream costs.

- **'Extras'.** Initial purchase costs of equipment may be greatly increased by the cost of such peripheral requirements as extra disk drives, printers, software, modems and furniture which are subsequently recognized as necessary.

- **Communications.** Except for pure 'standalone' applications, EUC often requires links to mainframes and other users for full exploitation. Thus, end-users' purchases can unexpectedly lever large expenditures in MF reprogramming, production and transmission costs.

- **Training and Support.** Despite suppliers' claims of how easy it is to learn to use their products, users will almost inevitably require additional training and support on an organized basis, often by scarce information systems professionals.

- As EUC spreads, therefore, the need to commit resources to end-user training will increase to meet the demand for:

  > widespread start-up training for existing staff and new recruits generally;

  > progressively higher levels of common proficiency among interrelated users; and

  > the retraining of larger numbers of managers and users to deal with successive systems enhancements.

- **Stress.** Considerable popular attention has been given to possible negative effects of workplace technology on people such as: fatigue, boredom and downgrading of skills. This involves the possibility of significant expenditures on enhanced air, heat and light controls, better designed furniture, and redesigning job functions to increase people's receptiveness to technological change.

- **Security.** Similarly, as EUC increases in operational importance, additional resources will be required for protection from systems breakdowns, data damage, loss, inaccuracy and misuse. (See Chapter VII)

- **Overbuying.** In contrast to the costs involved in failing to recognize the need for extras, there is a possibility that users might purchase products which exceed their requirements. Apart from the cost of buying unused capacity, this is also likely to increase the cost of training staff to use unnecessarily sophisticated systems.

- **Frivolous Demands.** As the EUC 'ethos' spreads, users may become competitive in selecting different and 'better' equipment and software; while managers might want personal computers and support packages as prestige items.

The potential for these forces to generate unplanned cost escalation is enormous. On the one hand, it is imperative that senior management understand the need to encourage, focus and harness the

benefits of EUC within a coherent technology strategy; and on the other hand, to control and measure its application.

4. Output Choices

Like mainframe investments, the purpose of EUC is to increase business effectiveness. This prompts the question: Should productivity gains be used to generate "more of the same, or more of something else"? That is: Should production and service levels be increased where the gains are generated, or should the 'saved' resources be transferred to serve other priorities?

The use of productivity gains is not likely to be an issue where the original impetus for investment is to reduce backlogs as a recognized program priority. But where the gains are needed to meet corporate priorities elsewhere, stripping branches of the rewards of their initiative may require deft persuasion.

5. Shifts in Responsibilities

The term 'End-User Computing' implies changes in the traditional responsibilities of end-users and information systems professionals. Generally, it involves users assuming increased responsibility in selecting HW and SW, programming, 'ownership' and control. For systems professionals it means a shift to more direct support of end-users, particularly in achieving higher levels of sophistication.

This question will be discussed in detail in Part B. Suffice it to say here, that end-users and ISPs will not find their new roles spontaneously without direction, planning and co-ordination by senior management.

C. ESTABLISHING THE BASES FOR SUCCESSFUL EUC

So far in this introductory review of EUC we have identified a range of issues and problems which require executive intervention and direction.

The following sections establish the logistical foundations of a viable EUC strategy:

1. **The Staff Resource Base.** Chapters III to V deal with ensuring the supply of trained end-users needed to support planned EUC investments.

2. **The Infrastructure Base.** Chapter VI deals with the acquisition and management of end-user equipment and software, with particular reference to the role of standards in governing choices. Chapter VII concerns data management and security.

PART B: THE STAFF RESOURCE BASE

Introduction

The first foundation of an EUC investment strategy involves providing potential end-users with the awareness, training and support needed to allow them to use HW and SW products with maximum effectiveness.

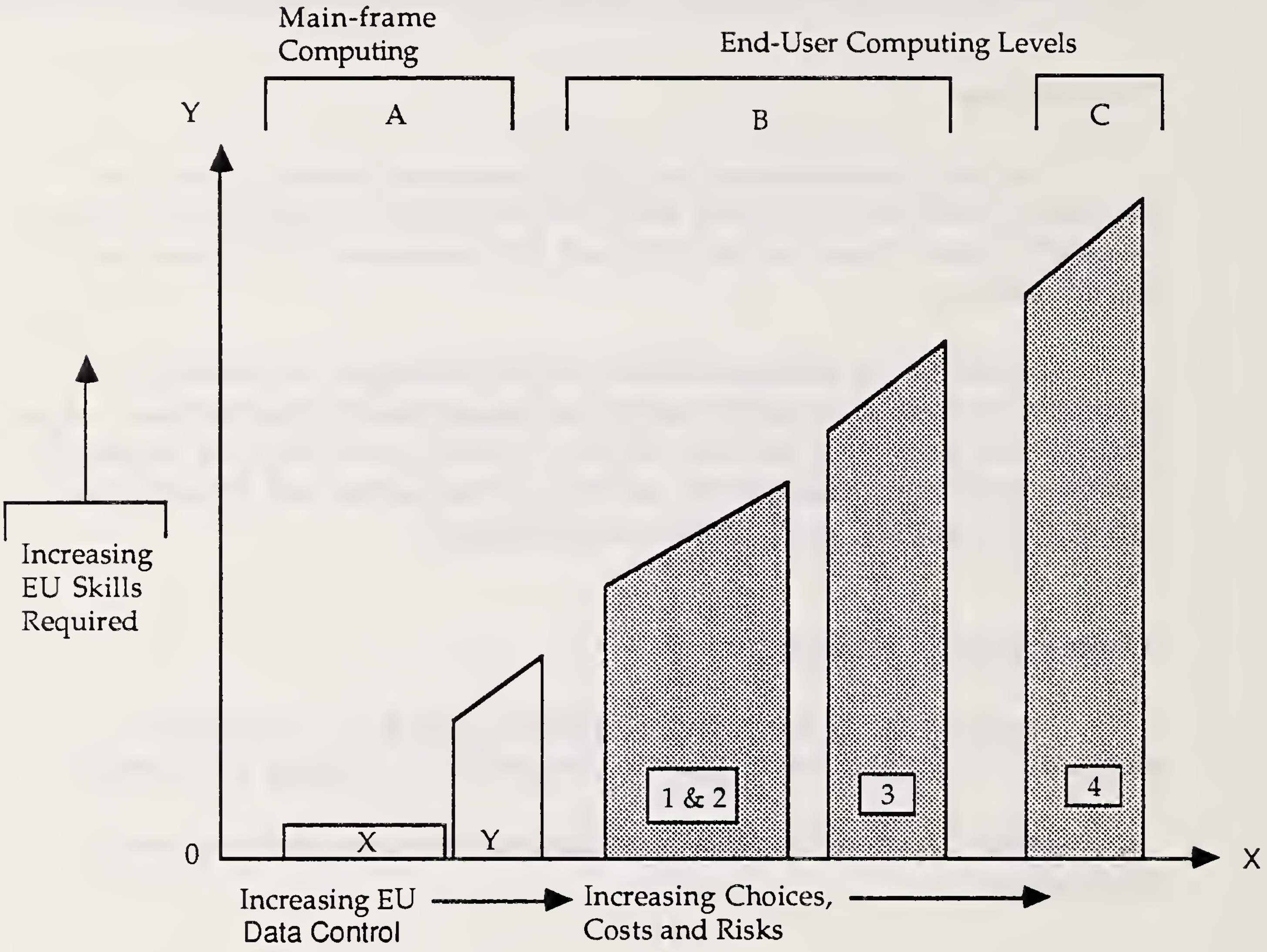
A shortage of motivated and trained managers and staff can seriously impede a ministry's ability to exploit new opportunities. More particularly, failure to provide the right training can result in increased running costs and breakdowns; as well as data losses and damage, and inaccurate analyses, transactions and decisions.

Summary and Organization

The purpose of the three chapters in Part B is to outline the elements of a co-ordinated approach to end-user training and support.

Rules One and Two cited in Chapter I are assumed to prevail throughout.

Diagram 3:1 END-USER TECHNOLOGY AND SKILLS


Main-frame Computing
End-User Computing Levels
A
B
C
Y
0
X
Increasing EU Skills Required
X
Y
1 & 2
3
4
Increasing EU Data Control
Increasing Choices, Costs and Risks

MAINFRAME		EU COMPUTING LEVELS		
X	Y	1 & 2	3	4
EUs Receive Batch Runs By Fixed Formats	On-Line Access to Fixed Data Sets	EUs Choose Vary & Run Programs. No Writing	EUs Write Programs Using EU Languages	EUs Write Programs Using ISP Tools

CHAPTER III: DEMAND FOR TRAINED END-USERS

In this chapter we delineate the factors which determine the demand for skilled end-users, as a necessary basis for investing in training and support capacities.

The demand for trained staff is described as a function of two factors:

- the **particular skills** required to support the different types of EUC products and applications which the ministry intends to install;
- the **range, scale and timing** of planned investments during the planning period.

A. DIFFERENT TECHNOLOGIES, DIFFERENT SKILLS

The wide variety of hardware and software options described in Chapter II produces an equally complex range of skills needed by users to ensure the efficient use of acquisitions. By its nature, however, EUC involves more than people's ability to operate their machines for their daily business routines. They must also be trained to take a more direct part in designing applications, HW and SW selections, and ongoing enhancements to their systems.

1. End-User Computing Levels

Diagram 3:1 provides a stylized representation of the relationship between:

- increases in the complexity of applications; and

- the skills required to support them.

In reality, EUC is a continuous function with almost infinite gradations and permutations. For presentation purposes, however, we have chosen a series of four levels to represent significant stages in which end-users gain increasing control of data selection, processing and analysis for their own business purposes (Dia. 3:1, x-axis).

2. Changing Responsibilities of ISPs and End-Users

In contrast with the virtually complete control of traditional mainframe computing by information systems professionals (ISPs), Panel B details the progressive increase in users' responsibilities associated with the EUC levels given in Diagram 3:1.

- **Levels 1 & 2** represent the first EUC breakthroughs using preprogrammed, inexpensive and proven software. Levels 1 and 2 are combined in the diagram to illustrate the range of sophistication of 'canned' software. At this stage, users gain considerable flexibility in the manipulation of data, but remain dependent on professional programmers for the development of custom applications.

- **Level 3** is where EUCs begin to write their own programs within the limits of application tools, such as FOCUS.

- **Level 4** represents the theoretical extreme of EUC, where users assume responsibility for all aspects of programming using the full range of ISP tools and procedures, such as COBOL and TELON.

- **Changing ISP Functions.** While users gain increasing control of programming and computing through Levels 1 to 4, ISPs remain responsible for required MF data-base management, processing operations, and communications systems. But most importantly ISPs become increasingly involved in advising and instructing users.

Table 3:2 END-USER SKILL REQUIREMENTS

END-USERS MUST UNDERSTAND	EU COMPUTING LEVELS				
	MF X	MF Y	1 & 2	3	4
• Nature & Limits of Data	x	x	x	x	x
• Output Uses of the Data	x	x	x	x	x
• Machine Operation		x	x	x	x
• Command Sequences		x	x	x	x
• Query Language			x	x	x
Syntax			x	x	x
Procedures			x	x	x
Structure			x	x	x
• Prog Generation Language				x	x
Data Relations				x	x
File Design				x	x
Syntax				x	x
• Programming Techniques					x
• Procedural Flows					x
• Program Design Standards					x
• Programming Tools					x

3. Required Increases in End-Users' Skills

Table 3:2 summarizes the skills users need to support the four levels of EUC by the columns shown in Diagram 3:1. The hierarchy of users' skills may be divided into common and specific skills.

- **Common Skills.** Throughout the sequence of MF and EUC, all users must:
  - > understand the nature and business uses of the data they are using;
  - > be able to specify their computing needs to ISPs; and
  - > master requisite machine keyboard and operating skills, and program command sequences.
- **Specific Skills.** The table also shows the types of skills users must acquire for end-user computing, such as understanding:
  - > the properties of pre-programmed software at Levels 1 and 2; and
  - > the intricacies of program generators at Level 3, and the full qualifications of ISPs in the extreme case of Level 4.

4. Costs and Risks

The lower x-axis in Diagram 3:1 notes that increasing EUC is matched by corresponding costs and risks.

- **Increasing Costs.** Mainframe Level X represents the ultimate in economical mass-data processing and cost controls. Starting with on-line access systems, increased end-user control variously involves additional SW, HW, communications and training costs.

- **Increasing Risks.** Similarly, EUC involves increasing risks of data misuse, damage and loss, while its effectiveness is dependent on users' command of HW and SW tools and access to accurate input data.

B. INVESTMENT & TRAINING STAGES

The second determinant of the demand for trained users involves when they are needed in relation to the timing of investments in new systems during the planning period.

1. General Theories of Technology Growth

Numerous writers have described the exploitation of new information technologies variously in terms of distinct and predictable stages of growth.[1] For convenience, these are compacted into three stages in Diagram 3:3, generally involving acceleration in the rate of investment until the scope for profitable applications is fulfilled, and in which:

- **Stage 1** represents the first exploratory applications of a technology, with limited production objectives or commitment to further development. The initial objective is to establish its operational viability and profitability.

- **Stage 2** describes the drive towards full exploitation of the technology, and its application to an increasing number of functions or programs.

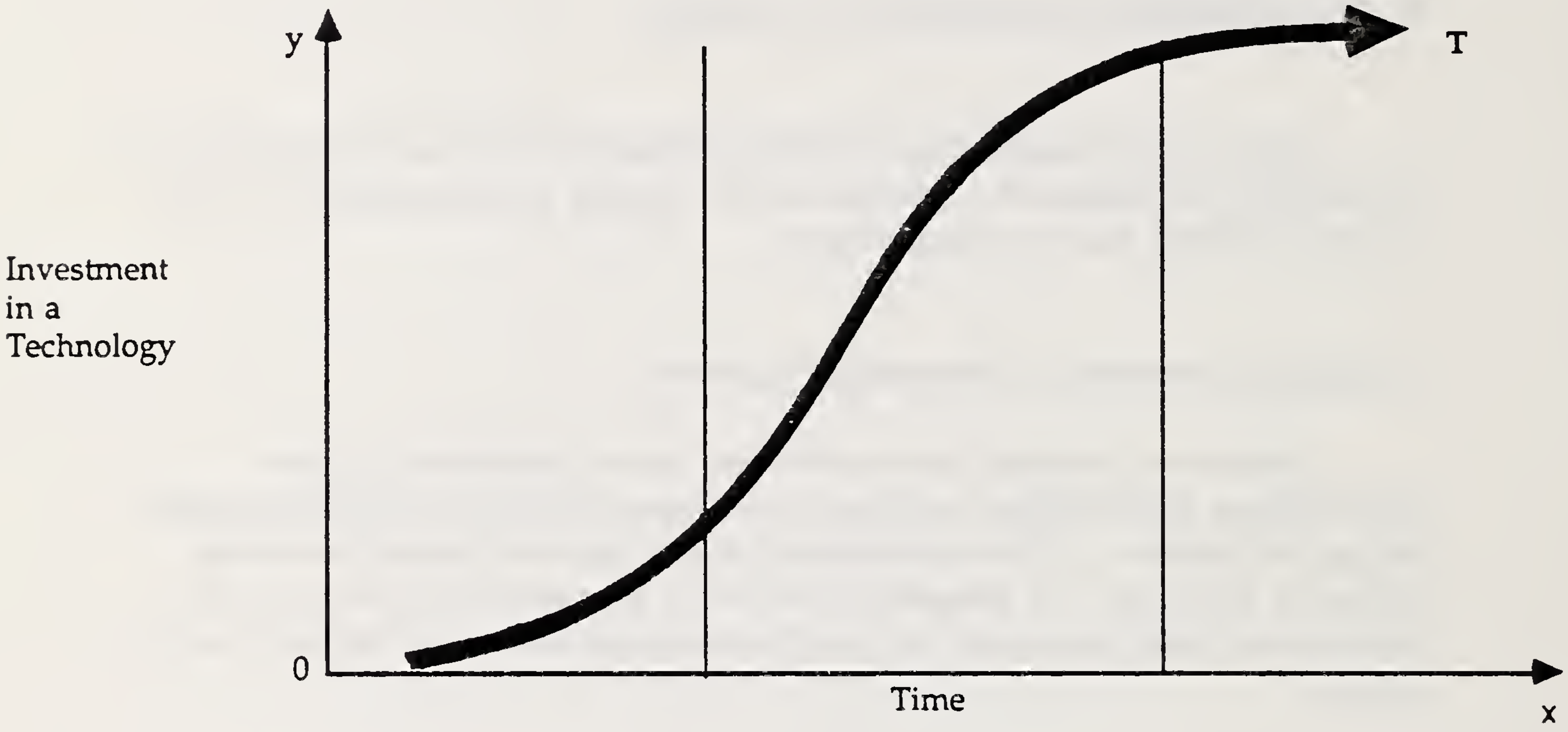
- **Stage 3** marks the deceleration of the investment process, as the technology reaches its full potential according to business conditions and its existing technical parameters.

---

[1] Richard L. Nolan and Cyrus F. Gibson, "Managing the Four Stages of EDP Growth", Harvard Business Review, January-February, 1974.

Diagram 3.3 SUMMARY OF TECHNOLOGY GROWTH STAGES

	1	2	3
A. GROWTH STAGES	Initiation & Experimentation	Acceleration & Proliferation	Maturity & Stability



	1	2	3
B. MANAGEMENT EMPHASIS	Tech Search, User Initiative, Prototypes, Loose Controls.	Maximum Productivity, Integrated Business & Investment Plans, Rigorous Mgt Practices, Policies & Standards.	Consolidation, Reappraisal, Tight Ongoing Management.
C. END-USER TRAINING	Small Numbers, Inform EU Groups, Assess Training Demand & Capacity, Train Trainers, Forecast EU Training Needs.	Increasing Numbers, Tie Training Needs to Business Plans & Cases, Commence Large-Scale Training Geared to Project Schedules, Adjust Work Condition.	Assess & Improve All Aspects of EUC Management, EU Training, Participation & Benefits.

2. Management Requirements

While general growth theories and our summary diagram are obvious simplifications, they provide useful first approximations of the requirements and problems of technology management in two ways.

First, the models emphasize that the success of technology exploitation is a function of:

- the cumulative momentum of successful projects; and
- concerted and sustained effort by management, users and information systems professionals.

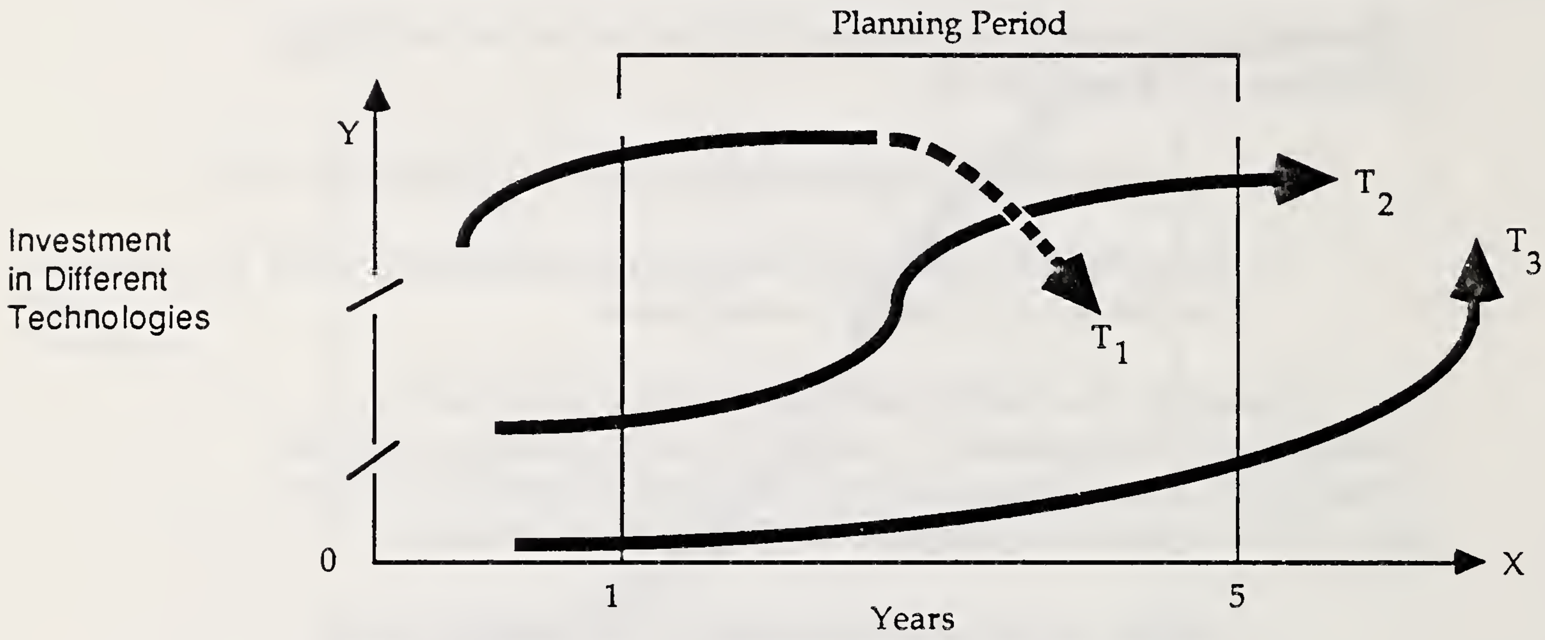
Secondly, the models are also useful in delineating management requirements, in terms of: what problems will be encountered at each stage; and what actions are needed at each stage. Thus Panel B in Diagram 3:3 shows the following:

- **Stage 1** requires an emphasis on encouraging user initiative and experimentation, and avoidance of inhibiting controls and protracted 'needs studies'.
- **Stage 2** entails progressively more single-minded attention to maximizing productivity gains; supported by more rigorous planning, co-ordination and business practices.
- **Stage 3** involves consolidation and fine tuning new systems, and attention to ongoing operational efficiency, maintenance cost controls, enhancements and replacement planning.

C. MULTI-TECHNOLOGY PLANNING AND MANAGEMENT

General models invariably deal with the exploitation of *one* type of technology. For example, Nowlan, and McFarlan and McKenney were generally concerned with traditional mainframe technology before the advent of multiform EUC technology. In practice, the technology investment process is considerably more complex than is suggested by the single T-curve in Diagram 3:3.

Diagram 3:4 CONCURRENT MULTI-TECHNOLOGY INVESTMENT AND MIGRATION



1. Managing Concurrent Strategies

A ministry, with well-established MF systems, like Revenue, is likely to be engaged in exploiting a variety of EUC technologies *simultaneously* across a wide range of programs. This situation is illustrated in Diagram 3:4 where:

- the ministry is pursuing several investment strategies involving different EUC technologies;
- each technology is at a different growth stage at any point in the planning period; and
- where, consequently, each technology requires a different form of management direction, support and controls.

2. Technology Migration and Disinvestment

A second complication is that specific technologies rarely offer unique and permanent solutions to users' business needs. The rapid development of new computing equipment and techniques has led to intense competition among alternative systems, and high rates of obsolescence among older systems.

Diagram 3:4 also illustrates a situation where a ministry is engaged in both exploiting new applications and disinvesting in earlier systems.

3. Discontinuities

Previous diagrams depicted technology development as a continuous and predictable process. Realistically, progress is just as likely to occur in 'fits and starts' because of funding, technical or operational problems, changes in business conditions and priorities, or simply its inability to digest constant change. The possibility of such disruptions, in turn, emphasize the need for flexibility by avoiding rigid, monolithic strategies and by disaggregating plans into discrete, self-contained projects.

CHAPTER IV: SUPPLY OF TRAINED END-USERS

Chapter III dealt with the complexities of demand patterns for skilled end-users. In this chapter we describe Revenue's approach to career development training for staff needed to support a diversified EUC investment campaign on a cost-effective and ministry-wide basis. Specifically, our approach involves three main components:

- evaluation of existing training policies human resources and capacities;
- mandating training responsibilities; and
- enhancing our training infrastructure.

A. ASSESSMENT OF EXISTING PRACTICES AND CAPACITIES

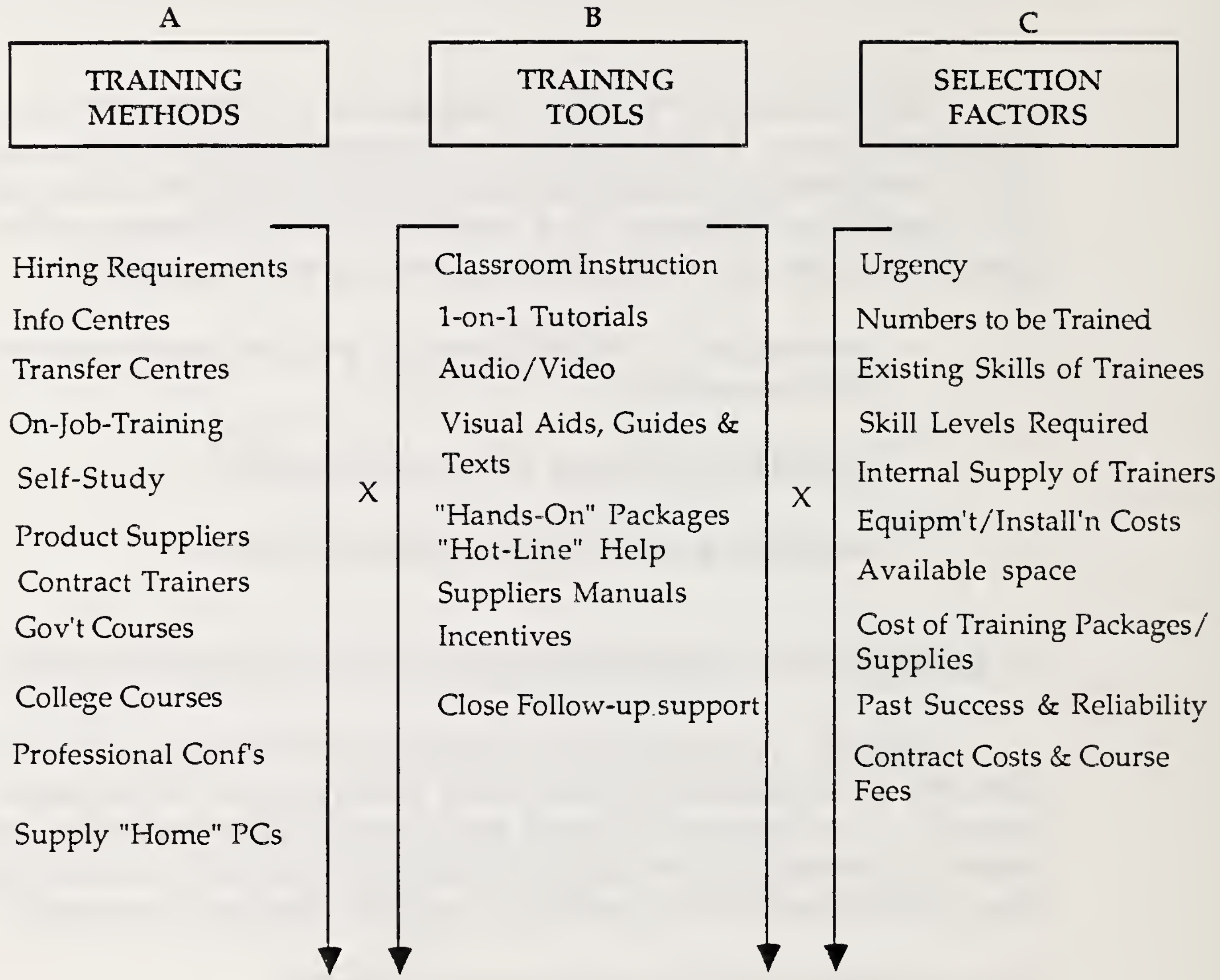
In Study 1 we said that an assessment of existing practices was the first step in strengthening technology planning and management generally. For the same reasons, an appraisal of the ministry's track record in developing technology skills is fundamental to identifying what improvements are needed to support planned investments.

1. Early Stages of EUC Investment and Training

Inevitably, training capacities will vary greatly among ministries. However, because of the relative newness of EUC and rapid expansion of applications, Revenue and other ministries are likely to share two main characteristics.

- Typically, they will not have established the full range of training policies and facilities needed for a large-scale investment drive.

Diagram 4:1 ALTERNATIVE TRAINING METHODS



A

TRAINING METHODS

- Hiring Requirements
- Info Centres
- Transfer Centres
- On-Job-Training
- Self-Study
- Product Suppliers
- Contract Trainers
- Gov't Courses
- College Courses
- Professional Conf's
- Supply "Home" PCs

X

B

TRAINING TOOLS

- Classroom Instruction
- 1-on-1 Tutorials
- Audio/Video
- Visual Aids, Guides & Texts
- "Hands-On" Packages
- "Hot-Line" Help
- Suppliers Manuals
- Incentives
- Close Follow-up support

X

C

SELECTION FACTORS

- Urgency
- Numbers to be Trained
- Existing Skills of Trainees
- Skill Levels Required
- Internal Supply of Trainers
- Equipm't/Install'n Costs
- Available space
- Cost of Training Packages/ Supplies
- Past Success & Reliability
- Contract Costs & Course Fees

- Consequently, training tends to be loosely organized and delegated to user-branches. Usually, this involves a reliance on on-the-job training, augmented by product suppliers or external training services on an ad hoc basis. (See Diagram 4:1)

In addition, during the early stages of investment, training tends to be focused single-mindedly on meeting the immediate needs of individual projects. As a result, little attention is given to co-ordinating training among branches, the cost of training, and delineating new career development patterns on a ministry-wide basis.

2. Benefits and Lessons of Initial Decentralization

While end-user training might be limited and loosely controlled during the exploratory stages of EUC, it is not necessarily the case that it is ineffective. Nor should it describe negligence by senior management.

In fact, in the absence of a fuller understanding of EUC and users' training requirements, decentralization is a tactically sound way for both senior and line-managers to gain the experience necessary for constructing common policies and capacities.

- **End-User Manager's Responsibilities**. Insofar as EUC must be 'end-user driven' ultimately, selected and limited prototypes can serve to establish the principle of branch managers' responsibility for determining training needs, as well as for including training costs in the evaluation of HW and SW options.

- **Need for Ministry Support**. Similarly, pilot projects should be used to identify what training and support services must be provided by the ministry when investment programs move into high gear.

- **Limited Costs and Risks.** While training costs may not be given close attention in exploratory applications, at least they can be contained within acceptable limits and provide experience for developing controls for later stages involving higher expenditures.

- **Immediate Results.** Where initial applications are purposely selected to generate quick and tangible results,

they can also serve to enhance the confidence of managers and users in the 'test branches', and provide competitive encouragement to other branches.

- **Trained Cadres.** Successful prototypes can provide a valuable nucleus of staff who can be trainers in the full application of the technology in the 'test branches' and its transfer to other branches.

- **Awareness of Long-Term Implications.** Local training experiences will provide indications of the longer-term activities needed to prepare staff generally for more widespread technological and organization changes.

In short, initial decentralization of end-user training can be both a necessity and a virtue. As in all new ventures, there are uncertainties and the prizes and satisfaction will go to those who are prepared to take calculated risks. Certainly, it is better to "get on with it", than to seek the comfort of protracted needs studies.

C. NEED FOR A CO-ORDINATED TRAINING STRATEGY

While loosely organized training may be effective and expedient in the exploratory stages of EUC, it is unlikely to meet the demands of a diversified and large-scale investment program as described in Chapter III.

1. Need for Executive Leadership

Consequently, in preparation for the second stage of technology growth it is the responsibility of senior management to establish a training and support strategy which will meet the need for:

- sustained increases in skilled staff, in line with longer-term technology investment plans;

- branch managers to concentrate on their main responsibility for the design and implementation of projects;

- economies of scale in end-user training; and

- migration of successful applications across the ministry.

Leadership and co-ordination by ministry executives should not involve the reduction of the role of user-branch managers. Explicitly, they should be directed to intensifying the importance of local initiative and tactical control of new applications. The objective is to ensure that line-managers and project teams are supported by the full weight of the ministry's resources and expertise in using new systems to achieve local productivity targets on a wide front.

2. Executive Actions

The objectives and practices involved in constructing a unified training program are essentially the same as those enunciated in our Study 1 for technology investment planning and management generally. In the next section we shall deal with required executive actions in terms of:

- How should training be integrated with a ministry's overall principles and practices of human resource management?[1]
- How should the supply of skilled staff be organized on a ministry-wide and cost-effective basis? and
- What are the roles of the Personnel Services Branch and Information Technology Division, and how should they be developed as an executive responsibility?

D. REVENUE'S MODEL OF END-USER TRAINING AND SUPPORT

In this section we describe the organization of end-user training and support in the Ministry of Revenue.

Revenue's user-training systems are designed to support our investment plans which have the following characteristics:

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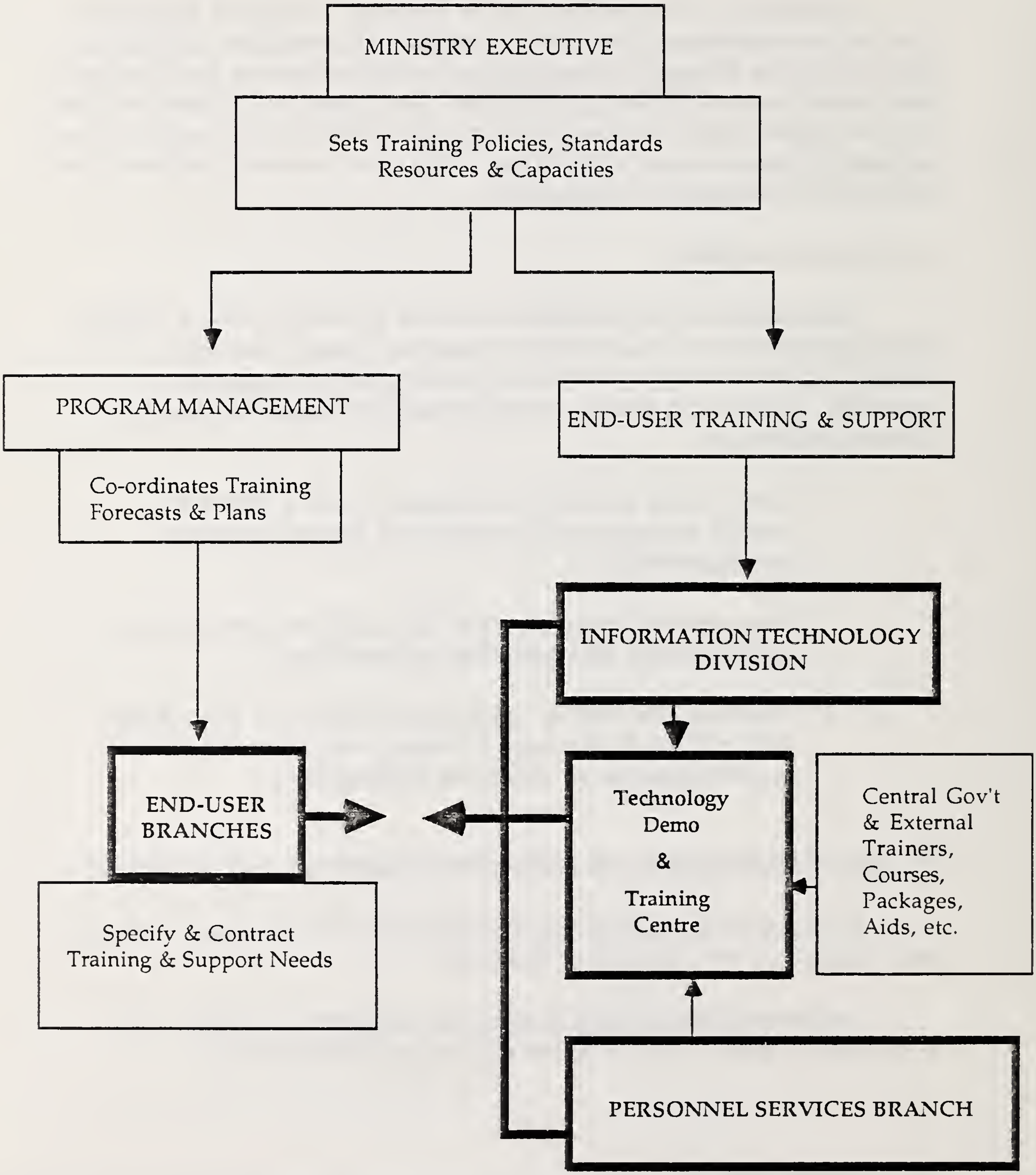
[1] For a full discussion of the importance and organization of human resources planning, see our Study 1, Chapter 3 and Appendix A.

Diagram 4:2 CO-ORDINATED EU TRAINING & SUPPORT


MINISTRY EXECUTIVE
Sets Training Policies, Standards
Resources & Capacities
PROGRAM MANAGEMENT
Co-ordinates Training
Forecasts & Plans
END-USER TRAINING & SUPPORT
INFORMATION TECHNOLOGY DIVISION
END-USER BRANCHES
Specify & Contract
Training & Support Needs
Technology Demo & Training Centre
Central Gov't & External Trainers, Courses, Packages, Aids, etc.
PERSONNEL SERVICES BRANCH

- a well-defined information and technology strategy and a full portfolio of specific projects for 3-to-5 years across the full range of our programs;

- established technology management policies;

- a full range of established MF data processing systems;

- considerable experience in end-user applications, albeit well below recognized potential; and

- a well-established Information Technology Division and Personnel Services Branch, with extensive experience in EUC training and support.

Diagram 4:2 provides a summary of Revenue's integrated approach to end-user training. Our model has the following functional properties.

1. Executive Direction

As explained in Study 1, the function of the Deputy Minister's Technology Strategy Committee (TSC) is to direct all aspects of user-training and support within a consistent framework of ministry policies, priorities and standards.

More specifically, our TSC is shown in the diagram to be directly responsible for co-ordinating end-user training across the ministry on a 3-to-5 year basis.

- On the Demand Side: it ensures that Programs' investment plans and project schedules are prepared with explicit recognition of the impact of technological change on existing staff and the demand for variously trained users.

- On the Supply Side: it mandated the Information Technology Division (ITD) and Personnel Services Branch (PSB) as the central 'suppliers', and provided them with the necessary funding and resources as a corporate priority.

Diagram 4:3 EU TRAINING AND SUPPORT MANDATES

INFORMATION TECHNOLOGY DIVISION

EMPHASIS

- Advise EU mgt on new HW/SW products, selections & applications
- T&S for initial EU cadres
- Ongoing EU assistance for specialized & advanced products & uses

MAIN FUNCTIONS:

- Direct Services
    - * product search & testing
    - * Standard HW/SW inventory
    - * Inventory of tested EU aids & tools
    - * 1-on-1 training, hotline assistance
    - * Negotiate & monitor suppliers
- Backshop Support
    - * HW/SW standards
    - * Data quality & security standards
    - * MF & EU programming & maintenance
    - * Communications & LANS

PERSONNEL SERVICES BRANCH

EMPHASIS

- Training large numbers of EUs for defined & established applications
- Ongoing training of recruits & replacements to EU specifications
- Linking EU training with HRP

MAIN FUNCTIONS:

- Direct Services
    - * Master curriculum for EU skill levels
    - * Standard in-house courses
    - * Evaluate & inventory external courses
    - * Advise EU mgt & design training to project specs & schedules
    - * Mgt education & training
- Backshop Support
    - * Advise & negotiate ext'l T&S contracts
    - * EU career counselling & planning
    - * Ministry inventory of EU skills
    - * Assess training costs, performance
    - * Research & external liaison

TECHNOLOGY DEMONSTRATION & TRAINING CENTRE

- Visible demonstration of the importance & range of EUC technology in the ministry
- Display, promote & demonstrate existing & potential HW/SW products & business applications
- Facilities & equipment for training courses, seminars, briefings, & self-help study
- Technology library & inventory of training programs, tools & equipment
- Also provides demonstrations & training for regional offices

2. Key Roles of the ITD and PSB

Diagram 4:3 provides details of the mandates of the ITD and PSB, as established by the Deputy Minister's TSC.

Relative Emphasis. In terms of their relative responsibilities, the distinguishing features of Revenue's model are that the:

- ITD is assigned the primary task of assisting end-user branches in the early stages of EUC applications, as well as ongoing instruction and support for advanced applications. These functions are derived from the ITD's established technology search and testing functions.

- PSB is mainly responsible for the standardized training of larger numbers of staff required as investments accelerate and proliferate in Stage 2. This role is based on the PSB's existing responsibilities for recruitment, personnel management and training generally.

Intermediary Roles. In performing their primary roles, both the ITD and PSB also act as intermediaries in buying external training services for their clients. Generally this involves the:

- ITD finding and testing proprietary training packages, as well as selecting and supervising any contract trainers required in the initial stages of applications.

- PSB establishing an inventory of proven external training suppliers and methods for training larger numbers of staff; advising user branches on selections, and negotiating on-going training contracts.

It should be emphasized that in designating the ITD and PSB as 'primary suppliers' it is not intended that they be granted exclusive or monopoly rights in their respective spheres. At all times they must demonstrate that their services are competitively cost-effective in meeting the expressed requirements of end-user branches.

3. Program Co-ordination

The purpose of Revenue's Management Committees is to provide unified direction of T&S in each of the ministry's Program Groups, according to strategic priorities established by the Deputy Minister's Technology Strategy Committee.

This includes ensuring that:

- all 3-to-5 year program investment plans and projects are developed with explicit recognition of their impact on staff and the need for skilled users;
- ITD and PSB management are fully informed of investment plans and projects, and armed with clients' staffing forecasts, specifications and delivery schedules; and
- all external training contracts, and in-house training are monitored.

4. Ultimate Responsibilities of End-User Branches

Study 1 described the functions of branch directors and project teams in the design and implementation of investment projects generally. These include responsibility for identifying EUC needs, preparation and retraining of affected staff, and training contracts with the ITD and PSB as shown in Diagram 4:3.

CHAPTER V: END-USER TRAINING IN REVENUE

In Chapter IV we explained, in general terms, our approach to supplying skilled staff to support the rapid growth in end-user computing systems across the ministry. In this chapter we describe our progress in applying our model since this study was originally published in 1985:

- through our new Technology Demonstration and Training Centre in Oshawa; and
- by expanding training and support services to our regional offices across Ontario

A. TECHNOLOGY DEMONSTRATION AND TRAINING CENTRE

Revenue pioneered the concept of in-house 'InfoCentres' in the Ontario government in 1978. Its value was demonstrated in completing our infrastructure of large mainframe systems and the development and support of our first EUC systems during 1978-82.

When the ministry moved to Oshawa in 1983, the InfoCentre was augmented by a range of additional training facilities in various locations in the building. However, the proliferation of applications was such that they quickly became inadequate in meeting the demand for skilled end-users. In December 1985, therefore, the InfoCentre and separate training activities were consolidated and expanded to form the Technology Demonstration and Training Centre (TDTC).

As the first of its kind in the Ontario service, the TDTC was specifically designed, equipped and staffed to provide a full range of initial and continuing EUC training and support on a ministry-wide basis. As such, it is a visible demonstration that:

- EUC skills have become pervasive job requirements throughout the ministry; and

Diagram 5:1

TECHNOLOGY TRAINING
January 1986 - October 1988

CLASSROOM INSTRUCTION:

EVENTS	TECHNOLOGY	PARTICIPANTS
i) PROGRAM APPLICATIONS		
• Ontario Assessment System (OASYS)	Mainframe On-Line	131
• Financial Information System (FIMS)	Mainline On-Line	498
• Ontario Pensioners Property Tax Assistance (OPPTA)	Mainline On-Line	200
• Corporations Tax Word Processing System	Distributed System	40
• Corporations Tax Field Audit Enhancement	Laptop PC	72
• Other	Mainframe/PC	954
SUB-TOTAL		1,895
ii) MICROCOMPUTER SKILLS		
• Introduction	PC	891
• Spreadsheets	PC	384
• Word Processing	PC	563
• Other	PC	619
SUB-TOTAL		2,457
iii) MISCELLANEOUS		
• Executive Workstation, etc.	Kontact, PC, Mainframe	250
GRAND TOTAL		4,602

- the ministry is committed to helping staff to deal with and benefit from technological change.

As described in Chapter IV, the TDTC is a joint undertaking of our Personnel Services Branch (PSB) and Information Technology Division (ITD). It consists of the following five units in two groupings:

End-User Training - PSB	EUC Support - ITD
1. Training Centre	3. Technology Showcase
2. Guided Learning Unit	4. Walk-in Services
	5. Information Centre

END-USER TRAINING

The two units in this group are operated by staff of the Training and Development Section of PSB, and are supported by specialists in the personnel and line-branches, as well as contract trainers.

1. Training Centre

Purpose: The centre's main function is to provide standardized, group training of users to support specific new systems or enhancements. Its clientele consists mainly of:

- existing staff and recruits without previous EUC experience; and

- other staff who must upgrade their skills.

Facilities and Equipment: The centre consists of a large room with sound-proofing, wiring, special lighting and climate controls. It can be divided into two classrooms, each of which can accommodate 12 MF-terminal or PC workstations and a wide range of instructors' aids.

Results: From January 1986 to October 1988, 492 sessions were held for 4,602 participants. This represents 803 instruction days to support 30 different EUC applications and SW packages. (See Diagram 5:1 for additional details.)

Diagram 5:2

GUIDED LEARNING UNIT
January 1986 - October 1988

Hardware	Software	Requests by Users
Mainframe	Intro. to 3270 terminal C. List Dialogue Manager FOCUS ISPF JCL	74
Mainframe / PC	Executive Keyboarding	54
PC	Intro. to PC DOS Typing Skills Wordprocessing LOTUS 1-2-3 DBase III FOCUS Speed Reading Project Management Others	1,681
VCR	FOCUS Local Area Networks Bits and Bytes CAD/CAM Time Management Others	98
VCR/PC	DBase III LOTUS 1-2-3 Others	413
		2,320

2. Guided Learning Unit

Purpose: This unit assists staff to acquire or upgrade EUC skills through private, self-paced tutorials.

Facilities and Equipment: It has five workstations; with a MF terminal, two PCs, two interactive PC/VCR units, a word-processing station, and over 50 tutorials ranging from basic keyboard skills and Lotus 1-2-3 spreadsheets to FOCUS and IBM DOS.

Results: From January 1986 to October 1988, there were 2,320 participants who used the Guided Learning Unit's facilities at our head office and in the regions. This included 559 participants who took advantage of the opportuntiy for evening and weekend self-study. (See Diagram 5:2 for details.)

END-USER SUPPORT

The following three units are operated by the Information Section of the ITD, and supported by other units of the division. The 15 specialists involved were moved into the TDTC for the express purpose of ensuring their accessibility to customers.

3. Technology Showcase

Purpose: Its mission is to promote awareness of the dynamic nature of information technology, by demonstrating new HW/SW products and their potential for profitable use in the ministry.

Facilities and Equipment: The Showcase features proven products presently in limited use in the ministry, as well as newly available 'leading-edge' products mainly on loan from suppliers.

Results: The Showcase has been instrumental in quickly bringing a number of new HW/SW products into productive use. For example, within months of their initial display in the showcase in 1986, laptop computers were succesfully introduced into the field audit functions of three taxing branches. Similarly, demonstrations of Office Automation products, including a variety of electronic mail and desktop publishing

Diagram 5:3

TECHNOLOGY SHOWCASE - HEAD OFFICE
January 1986 to October 1988

Themes:
- Audit Applications
- Graphics
  - software
  - applications
- Word Processing
- Laptop computers
- Optical Scanning
- Desktop Publishing
- Security Software

Hardware products demonstrated: 104

examples:
variety of Laptop computers
desktop personal computers
office automation configurations
printers - laser, portable, desktop
projection devices
graphics workstations
interactive video
variety of word processors
local area networks
IBM Personal System 2

Software products demonstrated:

examples:
user-developed applications
word-processing packages
variety of personal computer graphics products
project management products
desktop publishing software
personal computer networking software

Number of attendees at demonstrations:	2,059
Number of showcase visitors:	2,884
Number of external visitors:	1,111

applications, have also led to their adoption in various parts of the Ministry.[1] (See Diagram 5:3)

4. Walk-in Services

Purpose: This unit provides 'front desk', personalized help to users seeking specific information or assistance in solving immediate problems. Also, it provides devices for corporate use where it is not economically feasible to have more than one in the Ministry.

Facilities and Equipment: The unit has four workstations with various MF-terminal and PC configurations, as well as access to external interactive processing facilities.

Results: This unit ensures that applications developed by end-users incorporate good standards and development practices. As a result, reliable product support increases the confidence of end-users for maximum effectiveness. The unit also plays a valuable role in supplementing PSB training initiatives by 'one-on-one' coaching.

During the 1987/88 fiscal year, an average of 25 calls per day were serviced by the help desk 'hotline' function. Fourteen portable micro-computers which are loaned to Ministry staff for 'at home' work were fully booked for weekend and after-hours use. (See Diagram 5:4)

5. Information Centre

Purpose: The centre provides more specialized, proactive consulting services to user-branches and project teams in developing new applications and solving complex problems. This includes assistance in preparing Business Cases for program acquisitions and applications.

The unit is also responsible for the 'technology search' function. This involves identifying and testing of new products, use and development of standard product lines.

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[1] The TDTC does not supply products to user-branches. All such acquisitions must be supported by rigorous Business Cases, which demonstrate their technical feasibility and operational profitability.

Diagram 5:4 WALK-IN SERVICES

Workstation configurations	5
Software products available	55
User session bookings	avg. 6 hr/day
Number of hardware/software loans	1,000 per year
Hotline services (product support requests, information)	avg. 25/day
Portable micro-computers available for "at home" end-user computing	14

Diagram 5:5 INFORMATION CENTRE FOR FISCAL YEAR 87/88

Business Case development/ technical specification approvals	61
Workstation configurations acquired	330
Value of micro-computer acquisitions (Including peripherals and software)	2.8 million
Product evaluations (hardware and software)	115
Demand processing requests	121
Products supported (mainframe/mini/micro)	36
Technical service activities:	
Number workstation configurations supported	1,100
Service requests (includes: installations, diagnostic services, repairs, preventative maintenance)	avg. 120/mo.
Local area networks developed/supported	18

In addition, the centre provides ongoing support to Revenue's executive communications network of Kontact machines, which includes the Deputy Minister and 176 program executives, directors and managers in Oshawa, Retail Sales Tax offices and Regional Assessment offices.

Facilities and Equipment: All on-station staff are equipped with their own desktop devices, and are supported by equipment and expertise elsewhere in the ITD. They work closely with other R&D groups, such as Revenue Operations and Research, Assessment Data Services and branch planning units.

Results: This unit has materially assisted in the application of such leading-edge techniques and concepts as:

> generic workstations
> office automation
> laptop computers
> development of new EUC languages

During the 1987/88 fiscal year, Information Centre staff assisted in the development of 61 business case justifications, and technical analysis and specification for the acquisition of 330 workstations, related peripherals and software. These had a total purchase value of $2.8 million. (See Diagram 5.5)

6. Conclusion:

Since its opening in January 1986, the TDTC has established itself as a focal point of EUC activities in the ministry. Its training facilities are fully booked, and its consulting services are fully used. Altogether, some 4,600 participants have attended formal training sessions. Equally large numbers have attended product demonstrations. As a result, the level of staff interest and confidence in using information technology has increased markedly, together with the rate of new EUC applications initiated by end-users themselves.

The TDTC has attracted considerable external attention. Staff from 16 ministries and the Provincial Auditor's Office have visited the centre, as well as senior officials of the Auditor General of Canada and Quebec Revenue. It has been endorsed as a model by the Human

Diagram 5.6

OUTREACH SERVICES
January 1986 - October 1988

A. REGIONAL STAFF TRAINING

EVENTS	TECHNOLOGY	PARTICIPANTS
i) Program Applications		
• Ontario Assessment System (OASYS)	Mainframe On-Line	2,068
• Field Audit System	Laptop PC	59
ii) Microcomputer Skills		
• Introduction	PC	554
iii) Miscellaneous		
• Executive Workstation	Kontact	50
	TOTAL	2,731

B. REGIONAL END USER SUPPORT

	PROPERTY ASSESSMENT	RETAIL SALES TAX	CORPORATIONS TAX
Regional offices and sub-offices	41	9	1
Workstation configurations (Includes Laptops)	105	122	75
Users per office (average)	5	14	68
Software products used	4	9	7
Corporate applications (developed and supported by head office staff)	11	6	1
Hotline support calls	7 to 10/day	1 to 3/day	1/day

Resources Secretariat and a number of ministries have been given advice and information on establishing similar centres.

Tours have also been provided for several corporations, such as Guaranty Trust and Magna International, as well as Durham school board officials and school groups. As part of Revenue's Student Work Assistance Program, 34 students from four high schools have used the centre's facilities to gain PC programming skills by building programs for local charities. Another six summer students have been engaged in developing an on-line management and access system for a unique collection of 4,000 historical photos of Oshawa which were donated to the McLaughlin Art Gallery.

B. OUTREACH TRAINING AND SUPPORT

Problem: Section A described the high level of support now provided to 1,600 staff in Oshawa. But Revenue is highly decentralized, with 2,400 staff in 78 other locations across Ontario.

Thus, EUC investments depend on providing comparable T&S support to regional offices.

Our regional offices range widely in staff numbers from two in the Sudbury sales tax office to 155 in the Mississauga Regional Assessment office. None is large enough to merit a mini-TDTC. While the Metro, Durham and York assessment offices can be serviced by staff coming to Oshawa, others must be serviced by taking training and support to them. Revenue is using a variety of methods to achieve this. (See Diagram 5:6)

1. Training Trainers in Oshawa

One major challenge faced by Revenue was to train regional assessment staff in the use of the new on-line Ontario Assessment System (OASYS), and in the DB2 mainframe software. A total of 75 staff were specially selected to be 'trained as trainers'. They, in turn, took their system knowledge back to the field offices, where they trained a total of 1,900 regional office staff. Similar training on the Ministry's new Financial Information Management System will be extended to all 41 regional assessment offices in 1988.

Additionally, over 284 field office staff have come to the Ministry's TDTC in Oshawa for training on PCs, word processors, and KONTACTs (Revenue's current network of executive workstations).

2. Outreach Services

Each regional field office has a PC coordinator who is the central communications link with head office for micro-computing. The PC coordinator develops and administers controls and trains staff.

TDTC self-study materials are sent, on request, to the field for home-study purposes. A total of 7 portable PCs are available from the TDTC for home-study and/or regional training.

Refresher training on systems enhancements is ongoing. Last year, over 70 regional office trainers were brought to the head office in Oshawa for this purpose.

TDTC staff also make a point of visiting program events such as annual Institute for Municipal Assessors conferences. Discussions at these gatherings centre on the quality of applications that have been developed, and the training needs that have yet to be filled.

The potential exists for cooperation with the Human Resources Secretariat, other ministries and community colleges in providing technology training to regional staff. For example, in January 1988, 10 days of technology training in Toronto and Hamilton were delivered by trainers from Government Services and the University of Western Ontario. These services will be used whenever they meet Revenue's regional business needs.

3. Hotline

Regular field office training is supplemented by two 'hotlines': one operated by the Assessment Program for specific questions relating to the OASYS system, the other by the TDTC for other technology-related questions.

The TDTC for example answers an average of 220 technology questions a month by telephone.

PART C: MANAGEMENT OF THE INFRASTRUCTURE AND DATA RESOURCE BASES

In this Part, we deal with the construction and management of the Second and Third Foundations of a successful end-user computing technology investment strategy, namely the:

- Infrastructure Base of end-user equipment and software, and supporting mainframe and communications systems.
- Data Resource Base on which end-user computing ultimately depends.

Chapter VI deals with the development of ministry policies and standards governing the acquisition and use of end-user HW and SW products. Chapter VII covers the question of ensuring the supply, quality and security of data inputs and outputs.

Our treatment will not be concerned with the technical properties or engineering complexities of EUC which concern systems professional or project teams. Rather, our purpose is to explain the role of the Deputy Minister and senior program executives in ensuring that expenditures in these areas are planned and executed with maximum effectiveness in support of the ministry's business goals.

Rules One and Two cited in Chapter I are assumed to prevail throughout the following two chapters.

CHAPTER VI: HARDWARE, SOFTWARE AND COMMUNICATIONS STANDARDS

This chapter is intended to provide senior executives and program managers with a general understanding of the purpose of EUC standards, and when and how they should be applied.

We describe the importance for consistent but flexible policies and standards concerning EUC hardware and software choices, and the need to control the impact of such choices on mainframe and data transmission systems. In particular, the need to develop standards is explained in terms of their changing role in supporting an EUC investment strategy through the three stages of growth outlined in Chapter III.

A. THE PURPOSE OF EUC STANDARDS

In Chapter II we attributed the growth of EUC to the availability and flexibility of HW products and SW tools, which permit the application of small-scale computer technology to an increasing range of business needs. But we also noted that the free exercise of users' initiative entails risks of inappropriate technical choices, unplanned costs and inefficient utilization.

1. Business Imperatives and Practices

In Study 1 we emphasized that the ultimate purpose of all investment plans and projects is to improve program effectiveness and productivity. Technical standards and selections--whatever their functional characteristics and advantages--are valid only if they serve stated Business Plans and are capable of rigorous Business Case justification.

In practice, business imperatives may involve 'second best' technology decisions. For example, the need to achieve immediate output gains at low cost may dictate selections at the expense of higher downstream operating costs and compatibility with other systems. In

this case, the purpose of standards is to make such trade-offs explicit, and direct attention to minimizing conflicts between business and technical objectives.

2. The Need for Standards

The reason for standards that govern the selection and use of end-user HW and SW is essentially the same as for other industrial equipment and processes. In the area of information technology, the need for precise standards is well-recognized in, for example, the construction and modification of mainframe programs by information systems professionals.

Simply defined, standards involve identifying 'approved' or 'preferred' products for general or specified purposes, as well as procedures or guidelines for their acquisition and ongoing use.

Based on rigorous appraisal of the technical and operational characteristics of alternative products, there are several purposes for standards:

- **'Best Choices':** to assist project teams and end-users to select operationally proven and reliable HW and SW for particular business applications;
- **Compatibility:** to minimize unnecessary proliferation of different types of HW and SW, and maximize the selection of types capable of the broadest usage;
- **Costs:** to secure economies of scale in buying, using and maintaining HW and SW; and
- **Training:** to maximize economies in EUC training costs and ongoing support.

3. The Need for Flexible Standards

Balanced against the corporate advantages of standardization is the potential for standards to impede the successful application of EUC on 'the shop floor'.

Considerable emphasis has been given in previous chapters to encouraging users' initiative in finding technological solutions that best fit their business needs. Insofar as standards restrict local choices, it is imperative that they are, in practice, operationally sound and demonstrably helpful in achieving local investment objectives. Where there is a conflict, the standards should be changed or waived.

With the rapid development of improved HW and SW tools and the heterogeneous range of activities to which they are being applied, standards may be useful consolidations of **past experience** but of questionable validity in dealing with new options and business needs.

In the remaining sections of this chapter, therefore, we discuss the following key questions:

- **What** types of standards are needed?
- **How** should standards be developed, tested and modified?
- **When** are standards needed? and
- **Who** should be responsible for developing and applying EUC standards?

B. TYPES OF EUC STANDARDS

The potential for standards as imposed restrictions in the EUC field is almost limitless. In the extreme, standards can be developed to govern every conceivable product and activity (and in the hands of enthusiastic 'controllers' there is a distinct danger they will be!)

Our intention here is not to provide an encyclopaedic checklist of 'required' standards which **should** be in place in every ministry. As we have stressed repeatedly elsewhere, variations in ministries' experience and needs will create wide differences in what standards they need, and how they choose to develop and apply them.

Instead, we will attempt to describe generally what standards are **meant to achieve** in operational or functional terms. Or more particularly:

Table 6:1 DEVELOPMENT OF SOFTWARE STANDARDS

	IMPORTANCE IN	
PRIMARY CONCERNS	STRATEGIC APPLICATIONS	STANDALONE APPLICATIONS
End-User		
• functions performed by S/W	H	H
• ease of use	H	H
• ease of training	H	H
• availability of training tools	H	H
Senior Management		
• planned usage	H	H
• potential number of users	H	H
• adaptability to other tasks	H	L
• reliability of product	H	L
• quality of documentation	H	H
• licencing arrangements/ copyright protection	H	L
• security features	H	H
• long term support from vendor/manufacturer	H	H
• audit trail features	H	H
Technical		
• operating system	H	L
• functions performed by S/W	H	H
• error handling/backup features	H	H
• reliability of product	H	H
• adaptability to other tasks	H	L

- Are they **necessary** to achieve operational goals? and
- Are they **properly constructed** to meet those goals?

If standards meet these common-sense tests, they will perform a useful service in governing successive and repetitive applications. If not, they should be discontinued before causing more damage. Consequently, our Rule Two should prevail at every stage in the formulation and application of product standards.

1. Delineation of Technical Standards

Tables 6:1, 2 and 3, illustrate the range of factors which are involved in evaluating the operational capacities of competing HW and SW products and communications systems. Two general points should be noted.

- The tables distinguish between the need for standards for 'strategic' selections for widespread application and 'standalone' end-users. For example, in Table 6:2 HW compatibility is given a high priority (marked 'H') in selections for group uses, but a low priority ('L') for standalone situations.
- Obviously, HW, SW and communications standards should be mutually compatible. For example, HW standards should not specify equipment which cannot carry the SW needed or already used by end-users.

2. Software Standards

SW standards are designed to ensure the viability of end-users' decisions to make or buy programs, and their operational compatibility with existing or new hardware selections. In generic form, these standards usually state combinations of operating systems (CP/M, DOS, UNIX, etc.) and functions (electronic spreadsheet, data-base manager, word processor, etc.).

Table 6:2 DEVELOPMENT OF HARDWARE STANDARDS

	IMPORTANCE IN	
PRIMARY CONCERNS	STRATEGIC APPLICATIONS	STANDALONE APPLICATIONS
End-User		
• ability to run preselected software	H	H
• monitor/keyboard features	H	H
• data storage capacity	H	H
• ease of use/ease of training	H	H
Senior Management		
• planned usage	H	H
• compatibility with other installed (planned) devices	H	L
• ease of use/ease of training	H	H
• environmental requirements	H	L
• long term potential of manufacturer/supplier	H	L
Technical		
• operating system	H	H
• memory capacity	H	H
• bit size	H	H
• compatibility with other installed (planned) devices	H	L
• communications protocol	H	L
• power requirements	H	L
• environmental requirements	H	L
• keyboard/monitor features	H	L

Table 6:3 DEVELOPMENT OF COMMUNICATIONS STANDARDS

	IMPORTANCE IN	
PRIMARY CONCERNS	STRATEGIC APPLICATIONS	STANDALONE APPLICATIONS
Technical		
• protocol compatibility	H	L
• use of equipment in network situation	H	L

Table 6:1 describes a range of features involved in selecting SW, and which, therefore, should be expressed in ministry guidelines and standards.

3. Hardware Standards

Similarly, the features listed in Table 6:1 constitute a set of criteria designed to limit EUC hardware acquisitions by listing approved items (by brand name or generic specifications) according to various performance features, such as:

- bit size;
- operating systems;
- communications protocols;
- minimum internal memory capacity;
- external storage capacities; and
- communication rate.

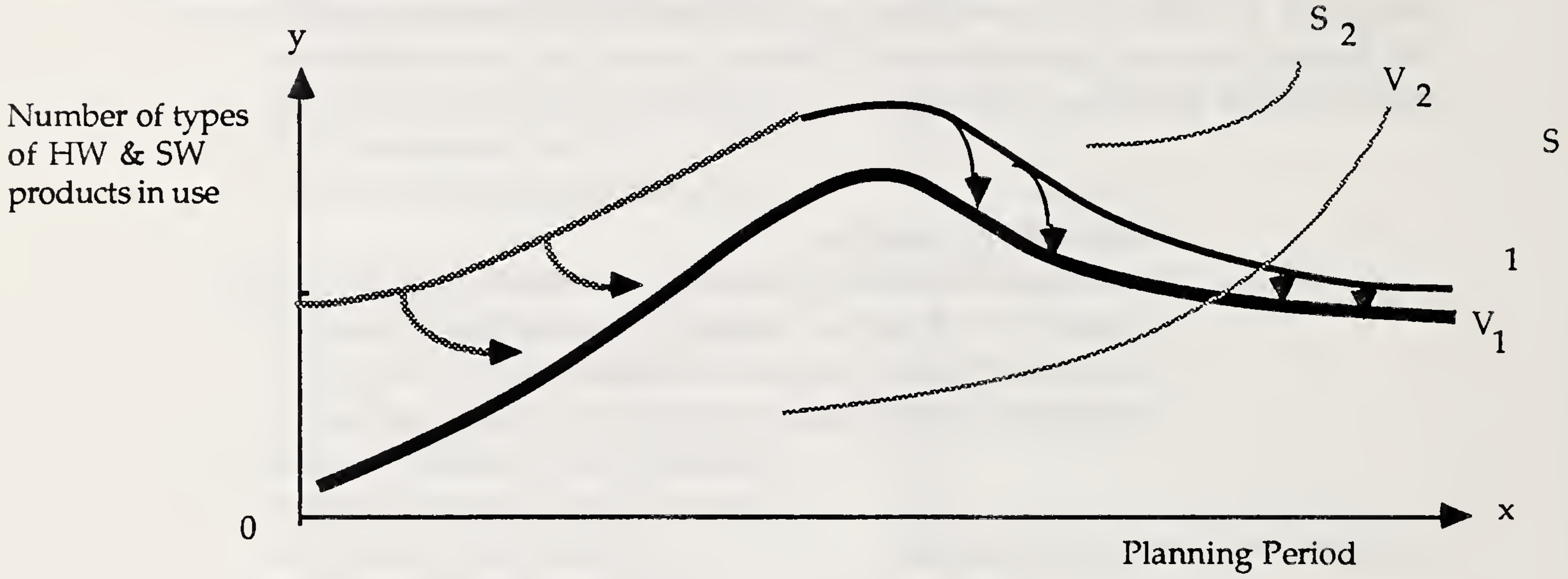
4. Communications Standards

Compatibility is the key to successful and cost effective linking of installed EUC and mainframe equipment. Communications standards should be designed to permit linking of end-user workstation devices into networks without expensive modifications to hardware and software. (Table 6:3)

In general terms, these standards should define minimum acceptable levels of compatibility related to the communications protocol.

Diagram 6:4 CONTROL OF HW AND SW CHOICES BY STANDARDS

	1.	2.	3.
A. GROWTH STAGES	Initiation & Experimentation	Acceleration & Proliferation	Maturity, Stability & Restart



Explanation

1. The V1 curve represents the number or variety of different HW and SW products in use through the three stages of technological growth.

2. The S1 curve represent policies and standards which control the selection and use of different HW and SW products (V1) through the three stages.

3. Thus: the shaded-portion of the S1 curve (and control arrows) in Stage 1 illustrates that standards are loose in order to purposely encourage the use of different HW and SW products. Hence the range of products increases fairly freely.

4. In Stage 2, however, the S1 curve is drawn as a solid line which presses down on the V1 curve, so that the number of different types of HW and SW products in use is reduced to a stable set of 'tested and approved' products in Stage 3.

5. Concurrently with the consolidation of products approved for continued and widespread use (as noted in #4 above): the V2 curve is drawn to represent ongoing experimentation with new generations of products, which are again loosely controlled until they are approved for standardized use.

C. DEVELOPMENT AND APPLICATION OF STANDARDS

In this Section we consider the questions of how standards should be developed and tested, and when they should be applied.

1. Approach: General Model

In Chapter III we summarized the process of exploiting new information technologies in terms of distinct and predictable stages. Then, in Chapter IV we described how end-user training should be planned to support the various stages of growth.

Diagram 6:4 is drawn to provide a similar generalization of the development and application of standards to guide the acquisition and use of HW and SW tools through the same various stages of technological growth.

2. Stage 1: Initiation and Experimentation

This stage represents the first exploratory applications, typically with limited production objectives or commitments to further development. During this stage, the main purpose of ministry executives and managers should be to:

- encourage initiative and innovation in using EUC;
- gain on-the-job experience in the selection, use, management and support of different products for different activities;
- provide a basis for more authoritative policies and standards to guide subsequent, fuller-scale investments;
- contain immediate costs and risks; and
- prevent pre-emptive decisions with large downstream cost implications.

During this period, standards should take the form more of guidelines on how to select and use HW and SW instruments, rather than strict instructions on which products must be used. As shown in

Diagram 6:4, the guidelines should be permissive, and not restrict end-users' enterprise.

Limited Group and Standalone Applications. Insofar as during this phase end-users are concerned typically with solving immediate and limited business problems, the role of senior management is to ensure that initial applications are orderly, businesslike and well supported.

In general terms, the standards define minimum acceptible levels of compatibility related to the communications protocols.

- **Establish Parameters.** Users should be required to state the objectives of pilot projects and explain their product choices, cost estimates and expected results as precisely as possible.

- **Accountability.** Responsibility for initial applications should be clearly specified.

- **Ensure Involvement and Support by ITD.** In our model in Chapter IV, the ITD was assigned primary responsibility for supporting user branches in this stage. For example, its 'missionary' role includes:

  > research on the technical and operational merits of competing HW and SW products;

  > assisting users to define their business needs and product specifications, and short-list options;.

  > advising users on product selections;

  > arranging suppliers' demonstrations and conducting on-site tests;

  > assisting in training end-user cadres; and

  > providing ongoing technical support.[1]

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[1] Revenue EUC services are provided by ITD staff on station in our Technology Demonstration and Training Centre. See Chapter IV, End-User Support, pg. 28-33.

- **Establish Information Exchanges.** Where similar projects can be identified elsewhere, arrangements should be made to share experience.

- **Acquisition of HW and SW.** Explicit consideration should be given to the subsequent reduction and consolidation of the number of products used across the ministry. To allow immediate freedom to EUCs to meet their short-term needs, this suggests they should be required wherever possible to:

  > borrow or lease, rather than buy HW; and

  > buy canned SW rather than program.

- **Avoid Impact on Other Systems and Users.** Early and limited EUC applications should not be allowed to inadvertently lever changes to mainframe systems, data bases or other program delivery units or activities.

Strategic Decisions. In contrast to the loose control of small-scale pilots or standalone installations, senior management should exercise tight control of larger-scale investments for the reasons cited immediately above. Such proposals should be deferred until a viable basis of EUC experience has been achieved. Or, if it is necessary to proceed, they should be subjected to the full rigours of the planning, design and testing, and business case practices described in our Study 1.

3. Stage 2: Acceleration and Proliferation of EUC Investments

In Chapter III this stage was characterized as a full-scale drive to exploit new EUC opportunities, based on the confidence and experience gained in the design and management of pilots in Stage 1.

While users should still be given wide latitude in experimental and standalone applications, the attention of senior management should concentrate increasingly on planning and coordinating investments on a strategic scale aimed at maximizing:

- productivity gains by applying proven applications to the widest range of business activities;

- economies of scale in buying HW and SW products; and
- the ability of MF systems, data bases and communications systems to support end-user networks.

Development and Application of Policies and Standards. In turn, the achievement of strategic objectives requires increased 'top down' direction and control of the selection, configuration and application of EUC products.

Diagram 6:4 illustrates the transformation of the loose guidelines of Stage 1 into more explicit standards in Stage 2. Progressively, the general force of these standards should be to:

- discard and prevent 'second best' products; and
- concentrate current and future selections in a narrower range of 'preferred' products, which are proven, supportable and capable of the widest general use.

Mainframes, Data Bases and Communications. Larger-scale EUC investments during this stage are also likely to require changes to supporting mainframe, data bases and communications systems. Policies will be required, therefore, to make sure that such changes are properly co-ordinated and costed.

4. Stage 3: Maturity

At this stage, the first wave of EUC investments reaches full operating potential and payoffs, along with the achievement of a solid basis of staff acceptance and skills, operating experience and management practices.

Ministry Objectives. As a result, the emphasis of executive attention should shift to:

- consolidating first-wave gains;
- setting new productivity targets; and
- ensuring the conditions necessary for continued exploitation of further opportunities.

Reset Policies and Standards. In turn, these objectives require the consolidation and revision of HW and SW standards to ensure they are still compatible with ministry business/technology strategies and users' needs and circumstances. In particular, they should be refined and proofed to ensure they are consistent, necessary and helpful in:

- maximizing the replication and adaptation of successful HW and SW applications;

- containing the growth of ongoing maintenance, data processing and transmission costs; and

- applying more sophisticated EUC to more complex or specialized business and technical activities: e.g. operations research, decision-support systems;

Continued Technology Drive. The maturing of the first wave of EUC investments should not be accompanied by stagnation. The need to generate continued productivity gains demands executive attention to the ministry's ability to generate a continued stream of investment opportunities. Insofar as this involves the exploitation of newly emerged HW and SW products, it requires the reinforcement or renewal of the spirit of enterprise and creative innovation on which a sustained 'technology drive' is always dependent.

D. GENERAL TONE

In this chapter we have discussed the need for increasing executive direction of EUC selections through the three stages of technological growth. At the same time, we emphasized that controls should be tempered by Rule Two cited in Chapter I.

We believe that ministry policies and standards should never be absolutely mandatory and enforced without question. In all cases, end-users should be allowed to depart from 'prescribed' products and techniques, provided they can demonstrate the validity and necessity of choosing others. In seeking exemptions for non-conforming choices, program managers, project teams and end-users should be fully aware that the ultimate test will be the successful achievement of planned business results.

CHAPTER VII: DATA MANAGEMENT AND SECURITY

Like mainframe computing, end-user computing is 'data driven and dependent'.

No matter how well users are trained, or the HW and SW infrastructure constructed and communications systems designed, EUC is invalid if the required data feedstocks are unavailable, flawed or incapable of computerised manipulation. It is for this reason that we have cited data management as the Third Foundation of EUC, and why data are designated as a 'corporate resource' in many organizations.

In operational terms, data management and security are a complex business. Our purpose in this chapter is to:

- outline why senior executives should be concerned, as part of the direction of an EUC investment strategy; and

- provide a framework for the development of ministry policies and standards on data resources, and the allocation of specific responsibilities for their application.

The creation, manipulation and interpretation of data within prescribed standards of accuracy is an **absolute requirement** for the validity of EUC. In Section A, we describe the elements of a ministry program designed to ensure the integrity of data. This is centred on training data makers and users, data standards and tests, and the establishment of an ongoing capacity to audit and improve data accuracy.

On the other hand, data security is a **relative requirement.** That is, the imposition of controls on the use of data involves trade-offs against the advantages of allowing the free movement of data according to users' needs. Also, the installation of security devices and procedures entail additional costs which must be balanced against the primary reliance on promoting high levels of awareness and observance among managers and staff. This is described in Section B.

A. ELEMENTS OF DATA MANAGEMENT

The importance of preparing and processing data according to precise standards of accuracy and consistency is well entrenched in mainframe operations. By its nature, however, increased commitment to EUC means the progressive expansion of data sources, uses and locations. Because these factors are not always amenable to tight centralized control, new management practices are required.

The importance of data integrity in mainframe computing is summarized by the worn adage 'garbage in, garbage out'. In EUC, however, the basic problem of quality assurance is extended to include 'getting the right information to the right people, on time and efficiently'.

For our purposes, the data quality and access needed to support EUC systems may be summarized in terms of a number of functions or requirements which should be recognized in ministry policies:

- users' data literacy, training;
- users' data needs, access and supply;
- data costs and efficiencies;
- data design and updating;
- data quality assuranceand integrity; and
- roles and responsibilities in data management and use.

1. Data Literacy, Training and Design

It is axiomatic that people who create, collect, select, manipulate, or interpret data must understand:

- what their data describe according to explicit rules of quantitative or qualitative measurement; and
- what questions their data are intended to answer.

In short, data must be relevant to their purpose and conform to stated standards of accuracy.

The basic requirements of 'good' data management in EUC are the same as in non-computerized professional or clerical activities. What is different is the greater complexity of data management, and therefore the potential for damage caused by inaccurate data and improper use. While these risks can be contained in standalone applications, the creation of EUC networks involves the danger of a 'chain-reaction' of compounded errors, and contamination through sequences of interdependent activities.

Under this heading, attention should be directed to establishing policies and processes at three levels of needs.

Basic Data Literacy. Just as in the common use of English in written and verbal communications, all data makers and users should possess a basic understanding of the properties of numbers and elementary statistical methods. As far as possible these requirements should be built into education and skill qualifications for hiring and promoting staff. But as we described in Chapter III, the rapid introduction of EUC will require the establishment of comprehensive training and skills upgrading services.

Functional Training. Recruits and staff generally may be numerically competent. But they will also need to understand the particular nature and use of data related to specific EUC applications to which they are assigned. As described in Chapter III, this requires specialized job-related training, which line-branch managers are best placed to specify and provide or contract out.

Data Designers. In practice, most users create, use and pass on data according to specifications established by others. The viability of EUC, therefore, critically depends on the expertise of branch planners and information specialists who are responsible for setting the rules by which data inputs/outputs are produced to meet users' needs. As a result, 'data leaders' must be selected and trained according to correspondingly higher standards of demonstrated competence.

2. Data Needs, Access and Supply

Having determined what data users need, the next group of questions concern how data are to be supplied and processed.

Need for EUC-Based Data Supply. Closely allied with *what* data are needed for business purposes, is the question of how data are best processed and transported among users. Before committing to EUC, its advantages should be demonstrated in competition with tried and tested 'old ways' (e.g. desk calculators) or other technological solutions (e.g. mainframe batch or on-line systems).

Different Users' Needs and Access. The next step concerns *who* needs *which* data. EUC allows a massive increase in the volumes and complexity of electronically produced and stored information. But 'all users don't want all data'. Therefore, data sets must be disaggregated into compact 'menus' or sub-sets for particular users to save time in accessing data, as well as to control production, transmission and equipment costs.

Data Supply. Finally, there is the question of how data should be delivered to meet users' needs most efficiently. This involves four main questions:

- Timing: How often do users need new and updated data?
- Form: Should data be supplied in hard copy, or electronic form?
- Source: Is the data coming from a mainframe, a mini, a PC based local area network (LAN) or another free-standing PC?
- Protection: Can the user protect the data being supplied from loss or degradation?

3. Updating Data

One of the advantages of mainframe computing is that it allows strict control of updating data bases, so that the costs and risks of inaccurate changes can be minimized and users know exactly how current data are.

By contrast, EUC raises the prospect of allowing much faster data updating, together with correspondingly larger risks of users entering inaccurate information or of other users not knowing how current data are. As with mainframe data, this requires the establishment of rules

governing who may make changes, pre-testing data before entry, and the dating of updates.

4. Independent Data Quality Assurance

Despite attention to user training, data design and update controls, however, the risk of data inaccuracy, damage or contamination is endemic in EUC.

For this reason, we paid particular attention in Study 1 to the need to establish an independent unit under the direction of the Internal Auditor, with an explicit mandate to establish a Data Quality Assurance Program.[1] Among the functions involved are:

- rigorous testing of data inputs and outputs in established MF and EUC operations, with particular reference to changes generated by program and systems modifications;
- pre-testing all new EUC installations and data sets, to identify potential 'blackholes' and damage points; and
- most importantly, the development of automatic, self-correcting quality tests and controls which can be built into EUC data routines.

B. DATA SECURITY

The issue of data security is not original to EUC. Most companies and ministries have installed facilities and procedures to protect confidential and irreplaceable information. In the Ministry of Revenue, for example, such protected information ranges from individual tax records to numerous operational and administrative data bases, which are stored in conventional hard-copy files and computer disks.

Mainframe installations are routinely equipped with access and delivery controls. However, the advent of EUC creates a new range of problems and risks associated with end-users working in 'open-office' situations and the portability of data disks. In short, once data move

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1. See Study 1, Appendix B

from the tightly controlled mainframe sites, data risks increase proportionately to the number of people using the data in local computing sites or field assignments.

Management Awareness. The first step is that executives and program managers must themselves realize the vital importance of data security, and the risks and costs of data damage, loss and misuse. To translate awareness into action, the responsibility of managers for ensuring that ministry policies and procedures are observed by other data users and custodians should be clearly established.[2]

Staff Awareness and Training. Obviously, data protection depends ultimately on the co-operation of the generality of end-users. This requires explicit 'game rules' for data makers and users, reinforced by an extensive program to promote awareness, and training in data protection routines. Like fire prevention and other 'best practices', observance should be an instinctive part of work discipline and conduct.

Data Targeting. The next step involves the control of data distribution to users on a 'need-to-know' basis. (We noted earlier that this is also important in controlling the integral part of designing EUC networks and should be routinely included in the responsibilities of Project Teams).

Entry and Access Controls. Along with the identification of target groups, it is important to ensure that access to the data is in fact limited to designated users. A wide range of devices and standards are available for this purpose, such as:

- passwords, 'dial-back' checks, and signature tests to prevent unauthorized access to data bases;
- matching passwords in personal computers and data disks, so that specified disks can be used only on specified machines by specified users; and
- encryption and scramblers to protect data in transit.

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[2] In Revenue, the Deputy Minister's Technology Strategy Committee is responsible for deciding how much is invested in data security systems and establishing custody rules. As well, the security tests are an explicit part of the process of approving investments. See Study 1, Part B.

Location Controls. In extreme cases, data entry/access can be confined to special high-security compounds, similar to mainframe and local mini-computer installations.

Portability and Transit Controls. This involves rules governing the use of data disks at home or in field activities, and the designation of data prohibited from off-site use.

Security Checks. Finally, the above measures should be included in an overall data security program. The program should also include regular or periodic checks of all security practices and standards, by managers, designated security officers and the Internal Auditor in order to:

- ensure high-levels of security awareness and observance on an ongoing basis; and
- identify weakness and necessary improvements.

2. Costs and Trade-Offs

In general terms, data protection involves trade-offs against the advantages of treating data as 'free resources' in EUC. Also, higher levels of security impose progressively higher costs in the design, purchase and installation of security systems, as well as in their operation and enforcement.

The aquisition of a dedicated mainframe computer facility at Revenue allows for higher levels of security. Since access can be tightly controlled and monitored for the one organization.

C. CONCLUSION

No set of policies, practices and devices can provide *complete* protection against data damage, loss or misuse. Controls can provide reasonable protection against accidental or careless damage. But full protection against insiders is virtually impossible (short of locking up data entirely or incurring prohibitive costs).

Consequently, management attention should be focused on obtaining a workable and affordable balance between security and end-users' access requirements. In practical terms, this dictates a primary reliance on users' awareness and co-operation, continued promotion of good practices, data classification and targeting to localize risks, and making managers and staff directly accountable for data in their custody.

Finally, to avoid creating an atmosphere of mistrust, surveillance and enforcement activities should be visible but not be offensive or oppressive. Penalties should be known, but applied with discretion.

CHAPTER VIII: FINANCE AND INTEGRATION OF INVESTMENTS

Increased dependence on technology is an expensive business. Notwithstanding falling unit costs, the total cost of installing, maintaining and using the growing mass of systems can be expected to grow rapidly.

Revenue is experiencing this in all areas in its use of technology but has found that old areas must continually undergo change to keep the unit costs down and that new areas of change must be closely studied.

For example, telecommunications has increased in use and cost as more information and processing is moved out across the province and as the technology becomes more complex. To control and rationalize these costs a complete understanding of this technology and its use must be attained through detailed study and review.

Paradoxically, just as constraints provide the imperative for finding more efficient ways of doing business, they can also seriously impede a ministry's ability to invest in new technology to generate the productivity increases needed to deal with them. In this chapter, we round-out this study with brief discussions of two additional requirements of a successful EUC drive:

- securing the supply of investment funds, either from internal sources or by competing with other ministries for scarce funds from Management Board; and

- co-ordinating the mass of EUC investments within a disciplined system of overall technology planning and management.

A. FINANCING AN EUC INVESTMENT DRIVE

No matter how capable the ministry is in planning, implementing and supporting investments, its ability to proceed--by how much and at what speed--depends on securing the required funds from internal or external sources.

1. Budget Allocations, Constraints and Cutbacks

Apart from unexpected instructions to mount new programs or radically change existing deliveries, the most important source of financial uncertainty are:

- the methods by which ministries' expenditures are ordinarily approved by government; and
- the prospect of constraints and cutbacks.

Annual Expenditure Allocations Process. The problem of financing long-term investments in face of the process by which the government allocates funds only on a year-by-year basis is well known. That is, except for major capital works, such as highway construction involving fixed commitments to contractors, investments in technology within ministries are typically treated merely as part of their overall Estimates allocations.

In times of overall budgetary stability ministries could expect a high degree of continuity in allocations and could forecast future flows with reasonable certainty. In more recent years, however, persistent government deficits have resulted in continued constraints. Typically, ministries are required, in varying degrees, to absorb inflationary and workload-growth pressures on a year-by-year basis. The only certainty is that while spending constraints will continue in subsequent years, their severity cannot be predicted with much certainty.

Under these conditions, a ministry is obliged to concentrate on maintaining existing program deliveries and public services, with technology investment being treated as a residual. As a result, there is a danger that new investments may proceed only in fits and starts as 'spare' funds become available. Indeed, under extreme conditions it is

possible that the shortage of funds will reduce the ministry's ability to maintain the computer systems it already has.

Finally, in-year budget cuts are particularly disruptive. By their nature they require emergency actions to protect program deliveries and contractual commitments, which, in turn, may require the deferral of approved projects or even force the cancellation of projects already started. Apart from confusion and financial waste, the effects on the morale and enthusiasm of planners, project teams and end-users can be particularly damaging.

2. Protective Actions

Clearly, the supply of investment funds in a ministry will always depend on the government's overall financial position and competition among ministries. Nor is the government likely to change the Estimates process, or protect funding from annual constraints. Consequently, a ministry's ability to sustain an investment strategy, requires that every effort be made to assemble the required funds from internal sources and deploy them with maximum effect.

Shaving Expenditures. Apart from redoubling efforts to eliminate pockets of unnecessary expenditures, ministries can resort to purposely stripping down current program operations below otherwise desirable levels and take calculated risks that they can be restored before weaknesses become apparent or seriously harmful to program deliveries.

Forego Maintenance and Replacements. Similarly, expenditures on existing systems can be deferred until they become absolutely necessary. Ultimately, however, there are limits to postponing such actions. Consequently, management should concentrate on ensuring that existing systems are subjected to the same discipline as new investments and scheduled as part of full Life-Cycle Management.[1]

Maximize Payoffs of New Projects. We have already discussed in earlier chapters the need to select projects which are capable of fast implementation to yield fast productivity gains to finance subsequent projects.

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1. As described in Study 1, Chapter VII

Control Data Processing and Transmission Costs. Along with budget constraints and cutbacks, the inexorable growth in data processing and transmission costs associated with increased technological dependence constitutes the second force which reduces the availability of new investment funds.

Like the Ministry of Revenue before 1987, most ministries purchase data processing services from either government or private bureaux. In this case, the objective is to extract maximum benefits from the economies of suppliers' technology.

- **Efficient Program Design.** The first step is to ensure that ministry applications are designed to minimize the use of processing and transmission cycles.
- **Tight Bargaining.** Then the ministry must exploit competition among suppliers to obtain the lowest possible cycle prices. Wherever possible, fixed-price contracts should be negotiated to maximum economies and price stability over time. (These tactics should apply equally to government and private-sector bureaus.)
- **Distributed Data Processing.** Where data transmission costs are high enough to significantly reduce the economies of central processing, attention should be given to leasing or buying mini-computers for decentralizing.
- **Ministry Owned Computer Facility.** At a certain point in the life cycle of using large amounts of DP resources, ministries must investigate the feasibility of acquiring and operating their own mainframe computers. This must be done to drive down and control the costs. The viability of shared processing has decreased significantly with the lowering of mainframe costs and the new simplicity of operations achieved over the past few years.

2. Aggressive Competition for Government Funds

While a ministry must place primary reliance on its ability to generate funds from its own resources, an accelerated and major EUC investment drive may still require additional external funding. In this case, it is vitally important that the ministry can compete vigorously

with other ministries for scarce central funds. This requires that the ministry can demonstrate that:

- it has a sound long-term strategy to exploit technology to increase productivity to the benefit of the government and itself;
- its immediate investment proposals are technically sound and offer explicit business payoffs;
- its technology planning and management processes and practices are effective; and
- it has a convincing track record of successfully completing past projects on time, within budget and delivering promised results.

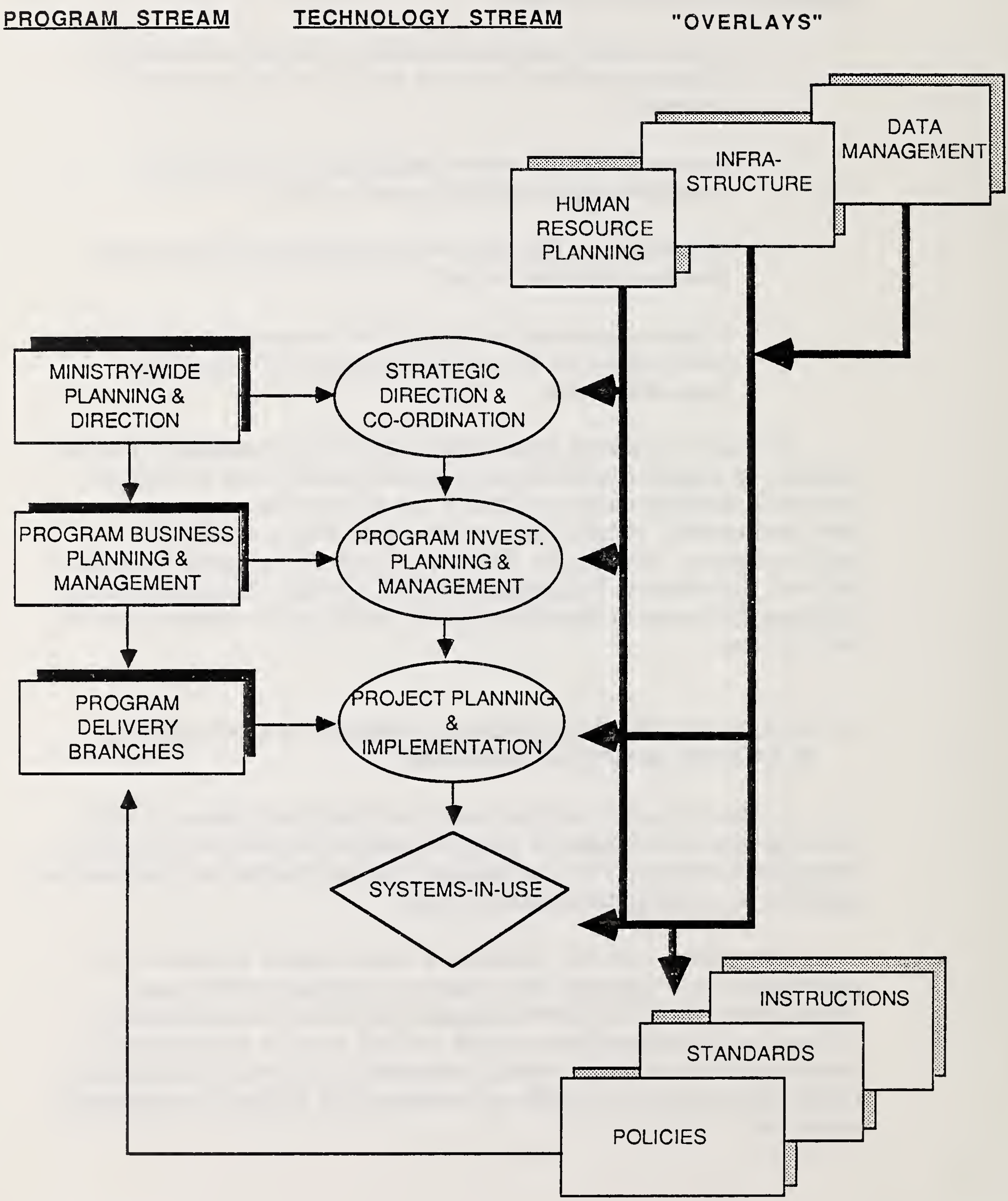
In short, in seeking government support it is reasonable that the ministry be expected to prove that it knows exactly what it wants to achieve in business terms, and that it can be relied on to produce promised results. Further, the ministry should seek to establish an explicit contract covering the division of productivity gains in terms of payback dividends to Management Board and their use in improving program deliveries or financing further profitable investments within the ministry.

B. INTEGRATION WITH OVERALL BUSINESS-TECHNOLOGY PLANNING AND MANAGEMENT

In Parts A and B we dealt with the Three Foundations of EUC which determine a ministry's ability to design and execute a concerted investment strategy. Then, in Section A of this chapter we discussed the question of securing the necessary funds.

Altogether, we have identified a wide range of activities and participants. It is apparent that unless the parts are welded into a unified force, there is a distinct danger that, at best, investments will proceed on a piecemeal basis, which will fall short of the sustained results needed to achieve strategic objectives. Or at worst, its 'strategy' could degenerate into a mêlée of confusion and reduced management credibility.

Diagram 8:1 INTEGRATED EUC MANAGEMENT


PROGRAM STREAM
TECHNOLOGY STREAM
"OVERLAYS"
DATA MANAGEMENT
INFRA-STRUCTURE
HUMAN RESOURCE PLANNING
MINISTRY-WIDE PLANNING & DIRECTION
STRATEGIC DIRECTION & CO-ORDINATION
PROGRAM BUSINESS PLANNING & MANAGEMENT
PROGRAM INVEST. PLANNING & MANAGEMENT
PROGRAM DELIVERY BRANCHES
PROJECT PLANNING & IMPLEMENTATION
SYSTEMS-IN-USE
INSTRUCTIONS
STANDARDS
POLICIES

1. General Approach, Principles, Methods

It was exactly because of the overriding need for executive direction and cohesion that our Study 1 was devoted to advocating an integrated approach to technology planning and management, based on commonly accepted principles, practices and objective tests.

For demonstration purposes, we developed a general model based on Revenue's experience, but which we held to be generally applicable to Ontario ministries. In summary, the model is designed to accommodate many of the requirements of an EUC strategy which have featured throughout this present study, such as the:

- domination of all technology decisions by the ministry's business plans and operating priorities and requirements. (Rule One);
- importance of 'top down' leadership and 'bottom up' participation by end-users. (Rule Two);
- need for strategic planning and targets, the application of rigorous Business Case methods to all new projects, and tight management of existing investments and costs; and
- designation of responsibilities among participants at all levels, reinforced by performance contracts and accountability.

2. Incorporation of EUC Requirements

Study 1 was concerned with large-scale investment planning and management in general without particular attention to particular types of information technology. However, our model can be readily adapted to incorporate the specific requirements of an EUC strategy covered in this paper.

Consequently, in Diagram 8:1 this integration is illustrated by fitting a series of 'overlays' to the basic model, by which the Three Foundations of an EUC investment strategy are directly incorporated into the planning and management sequence, and are subjected to the same principles, practices and discipline as described in detail in Study 1.

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